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SECTION 01
LAND RECLAMATION

THERMOVISION APPLIED FOR STUDYING THE ELECTROMECHANICAL TRANSMISSIONS OPERATION

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Abstract

The paper presents experimental reserch results during an industrial technological practice internship organized according to a pedagogical cooperation convention signed between the University of Balamand - Techological University Institute – Issam Fares, and University of Craiova. The paper presents relevant thermogrames obtained during experimental researches concerning both several new or old electromechanical products, and maintenance aspects, too. The thermogrames are in detailed explained considering the interdisciplinaries concepts concerning all the stages of electromechanicals produces making such as desinging, technological making process, assemling operations, quality control, maintenance aspects, and possible environmental impact aspects.

Key words: thermovision, electromechanical transmissions operation, environmental impact

INTRODUCTION

Infrared thermography (IRT), thermal imaging, and thermal video are examples of infrared imaging science. Thermographic cameras detect radiation in the infrared range of the electro-magnetic spectrum (roughly 9–14µm) and produce images of that radiation, called thermograms. Since infrared radiation is emitted by all objects above absolute zero according to the black body radiation law, thermography makes it possible to see one's environment with or without visible illumination. The amount of radiation emitted by an object increases with temperature; therefore, thermography allows one to see variations in temperature. When viewed through a thermal imaging camera, warm objects stand out well against cooler backgrounds become easily visible against the environment, day or night. A thermal imaging camera is capable of performing algorithms to interpret that data and build an image. (https://en.wikipedia.org/wiki/Thermography).
Advantages of thermography: it is capable of catching moving targets in real time; it is able to find deteriorating, i.e., higher temperature components prior to their failure; it can be used to measure or observe in areas inaccessible or hazardous for other methods; it is a non-destructive test method; it can be used to find defects in shafts, pipes, and other metal or plastic parts (http://www.flirmedia.com/MMC /THG/Brochures/ T820264; www.micronix.ro).
Thermal imaging cameras are commonly used for inspections of high voltage and low voltage electrical systems and components in all sizes and shapes (www.micronix.ro; www.flirmedia. com/ MMC/THG/Brochures/T820264).
In many industries, mechanical systems serve as the backbone of operations. Thermal data collected with a thermal imaging camera can be an invaluable source of complimentary information to vibration studies in mechanical equipment monitoring. Mechanical systems will heat up if there is a misalignment at some point in the system. Conveyor belts are a good example: if a roller is worn out, it will clearly show in the thermal image so that it can be replaced. Typically, when mechanical components become worn and less efficient, the heat dissipated will increase. Consequently, the temperature of faulty equipment or systems will increase rapidly before failure. By periodically comparing readings from a thermal imaging camera with a machine's temperature signature under normal operating conditions, it can be detected a multitude of different failures

(www.micronix.ro; www.flirmedia.com/MMC/ THG/Brochures/T8202640).

Infrared Thermography testing is one of many Nondestructive testing techniques designated by the American Society for Nondestructive Testing (ASNT): infrared Thermography is a nondestructive, remote sensing technique, has proved to be an effective, convenient, and economical method of testing concrete. It can detect internal voids, delaminations, and cracks in concrete structures such as bridge decks, highway pavements, floors and pavements, and building walls. As a testing technique, some of its most important qualities are that it is accurate; it is repeatable (www. flirmedia.com/MMC/THG/Brochures).

According ISO, in industrial electromechanical applications, infrared Thermography is reglamented by the standard ISO 18436-7, Condition monitoring and diagnostics of machines - Requirements for qualification and assessment of personnel - Part 7: Thermography (www.micronix.ro; www.flirmedia. com/MMC/THG/Brochures/T820264).

Infrared monitoring and analysis has the widest range in predictive and proactive maintenance application (from high - to low - speed equipment), and it can be effective for spotting both mechanical and electrical failures; some consider it to currently be the most cost - effective technology (www.flirmedia.com/MMC/THG/ Brochures/T820264; www.micronix.ro).

International standards for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids (Eckhoff, 2003; Hatwig & Steen, 2004) contain comprehensive guidance on the control of dusts to prevent explosions. The vast majority of natural and synthetic organic materials, as well as some metals, can form combustible dust. International Industrial Fire Hazards standards (Hatwig & Steen, 2004) state that "any industrial process that reduces a combustible material and some normally noncombustible materials to a finely divided state present a potential for a serious fire or explosion." A combustible dust explosion hazard may exist in a variety of industries, including: food (dust cloud such as grain, flour, sugar, pollen, powdered milk), plastics, wood, rubber, furniture, textiles, pesticides, dyes, coal, metals (e.g., Al, Cr, Mg, Zn, iron), and fossil fuel power

generation (Eckhoff, 2003; Hatwig & Steen, 2004). There are four necessary conditions for a dust explosion or deflagration: a combustible dust; the dust is suspended in the air at high concentration; there is an oxidant (typically atmospheric oxygen); there is an ignition source. To support combustion, the dust must also consist of very small particles with a high surface area to volume ratio. In agriculture and food industry the dust can arise from activities such as transporting grain and indeed grain silos do regularly have explosions. Flour mills likewise have large amounts of flour dust as a result of milling. Some devastating and fatal explosions have occurred at flour mills (including an explosion) and a series of devastating grain dust explosions in grain elevators left many people dead and injured (Eckhoff, 2003).

According to international general standards for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities, to prevent fire hazard in flour milling process, the operation temperature must not exceed 80°C.

In University of Craiova previous experimental research were focused on thermovision applications' to prevent fire hazard in flour milling industry (Rosca & Rosca, 2011).

A thermal imaging analyze revealed an intense overheat of the sliding bearing of a rolling flour mill. During consecutive Thermovision monitoring a fast increase of the sliding bearing' temperature was observed: after 30 min from the starting of milling process the maximum temperature in thermal image was 139°C (Figure 1), and then after just 30 min the maximum temperature increased up to 151°C (Figure 2).

Due to these Thermovision monitoring results, the flour milling process was proposed to be stopped. During the mechanical evaluation it was observed a very high ware rate of the sliding bearing; therefore this machine element was replaced with a new one.

Figure 1. Sliding bearing overheated at 139°C
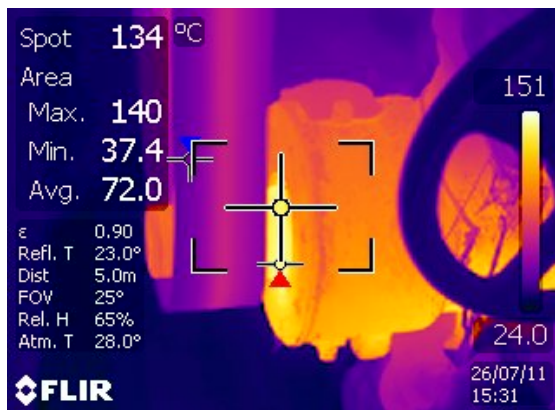
Figure 2. Sliding bearing overheated at 151°C
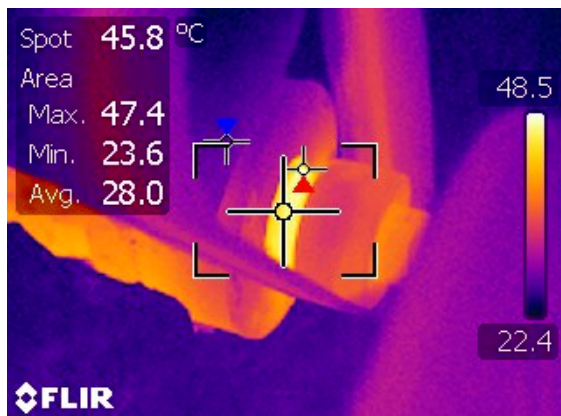
Figure 3. Sliding bearing in proper operation 48,5°C

After 30 min from the flour milling process start, the Thermovision monitoring revealed a proper temperature at about 48,5°C (Figure 3) in all thermal image (Rosca & Rosca, 2011).

MATERIALS AND METHODS

According to a Pedagogical Cooperation Convention signed between the Techological University Institute - Issam Fares within University of Balamand - Liban and University of Craiova - Romania, the University of Craiova organised a student industrial technological practice internship.

For this industrial technological practice internship, University of Craiova signed Collaboration Partnership Protocols with three representatives industrial companies in Craiova interested in hosting industrial practice of foreigner students, and to organise and monitorise all the student's industrial technological practice internship: SC Cummins Generator Technologies SA - Craiova; SC POPECI Heavy Equipment - Craiova; SC RELOC S.A. COMPANY - Craiova. According to the products making stages within these companies, the thermovision was used to study the electro-mechanical transmissions operation for the products making technologies.

During the experimental researches, FLIR T200 infrared camera (wave range 7,5 - 13μm) was used. The emisivity, the ambient tempe-rature, the reflected temperature, the humidity and the distance to the object surface were setted on the infrared camera each time when was necesary (www.micronix.ro).

RESULTS AND DICUSSIONS

In SC Cummins Generator Technologies SA - Craiova, the practice tutor established the practice program according to the products making stages in Impregnation Section.

During the experimental researches the heating oven components were evaluated. In Figure 4 is presented the thermogram that shows the correct operation of the oven's ventilation system (90,7°C maximum ventilator tempera-ture) during the preheating process (100°C) for moisture elimination (Al Isber, 2013).
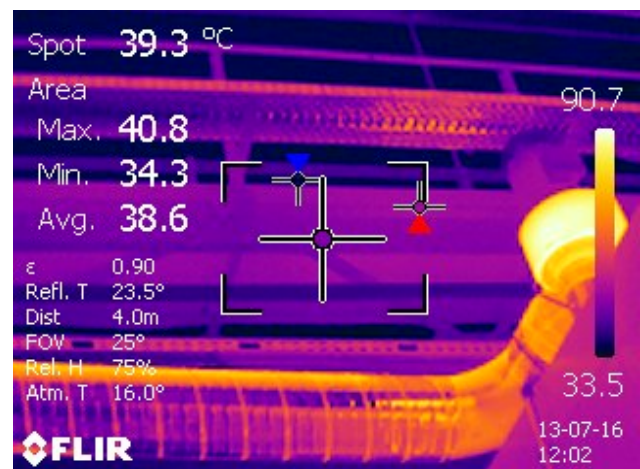
Figure 4. Correct operation of the oven's ventilation system (90,7°C maximum ventilator temperature) during the preheating process (100°C) for moisture elimination
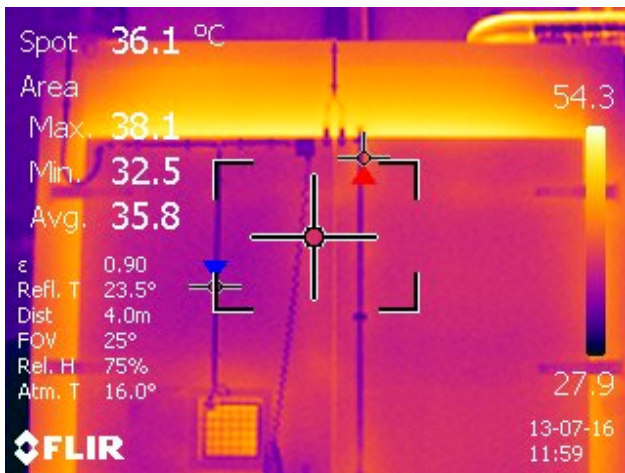
Figure 5. Low quality isolation between the oven's
doors, and the oven's frontal side (54,3°C)

But in the same experiment the thermograme revealed (Figure 5) low quality isolation (54,3°C) between the oven's doors, and the oven's frontal side (Al Isber, 2013).

Therefore the practice internship supervising teacher addressed collegial recommendations to the Impregnation Station maintenance team.

In SC POPECI Heavy Equipment SA - Craiova, the practice tutor established the practice program according to the products making stages, and according the Simulation Test Bench and Gearing Systems Laboratory programme and Mobile Research Laboratory programme, too.

During the experimental research, the thermo-vision revealed no thermic problem in heavy equipments operation (due to maintenance or intensive mechanical cutting processes).

During the experimental research within Simulation Test Bench and Gearing Systems Laboratory, thermovision evalution of a special multiple orbital gear box was realised.

The special multiple orbital gear box is the main component of surface mining combine driven system.

The first stage of the special multiple orbital gear box consists in an arhi-medic warm gear with 135 transmission ratio.

In similitude with in mining process, the special multiple orbital gear box was actuated by an electrical motor at certain rotational speeds, and a high performance hydraulic system (used as brake system to realise constant or variable resistent torque moment).

In real mining process time the special multiple orbital gear box is charged in four constant or variable resistent torque moment.

Thermovision revealed that one of the most loaded gear stage into the special multiple orbital gear box is the arhimedic warm gear, and for each loading stage, temperature increase of arhimedic warm gear was observed.

The thermogrames revealed that higher tempe-rature occurs in the radial - axial bearing from oposite traction part of the arhimedic warm gear (Figure 6): in the first loading stage 47,6°C maximum temperature (a); in the second loading stage 52°C maximum temperature (b); in the third loading stage 54,9°C maximum temperature (c); in the fourth loading stage 56,9°C maximum temperature (d) (Al Isber, 2013).

These temperatures confirm the designing corect-ness of the special multiple orbital gear box.
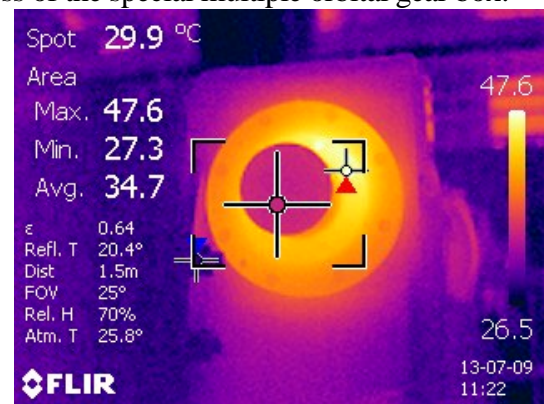
a) the first loading stage (47,6°C maximum temperature)
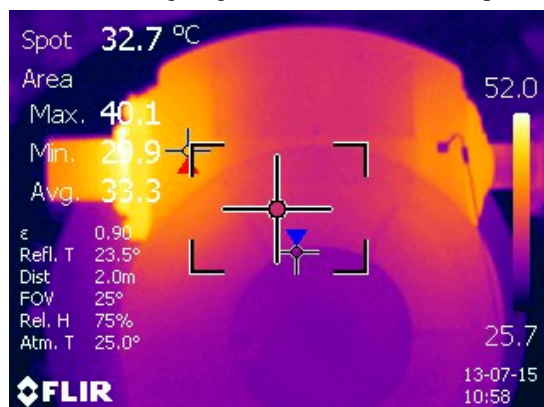
b) the second loading stage (52°C maximum temperature)
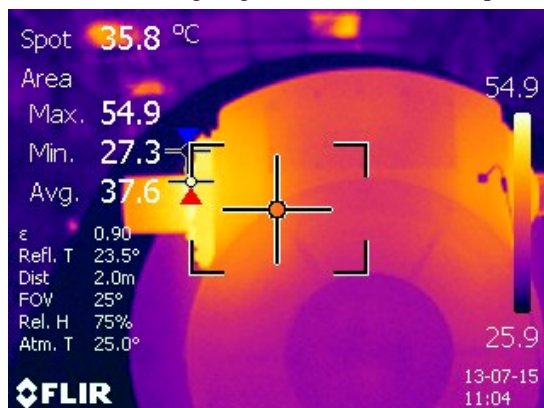
c) the third loading stage (54,9°C maximum temperature)
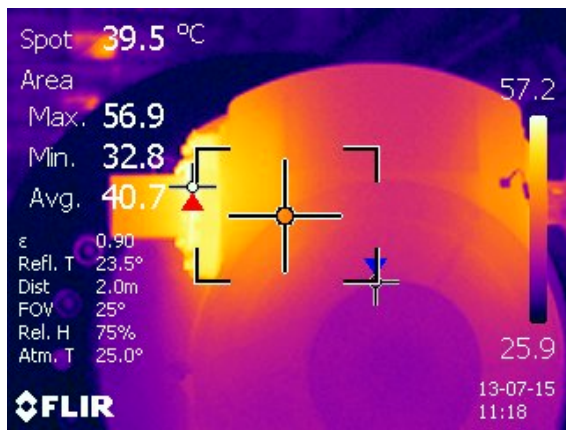
d) the fourth loading stage (56,9°C maximum temperature)

Figure 6. Higher temperature occurs in the radial - axial bearing from opiste traction part of the arhimedic warm gear

In these experimental researches an interesting temperature behavior in the frontal side of the radial-axial bearing (from opiste traction part of the arhimedic warm gear) was observed: the maximum temperature 47,6°C recorded in the same place / point (Figura 6,a).

These tempera-tures picks could be determined by screwing torsion moment uniformless that occured in radial-axial bearing mounting operation (Al Isber, 2013), therefore the practice intern-ship supervising teacher addressed collegial recommendations to the assembling technical team.

In SC RELOC S.A. Company - Craiova, the practice tutor established the practice program according to the electrical motors of diesel - electric locomotives making stages, and according the Electrical Motors Testing Laboratory programme, too.

In the preliminary electrical tests, two electrical motors are installed on a metallic rigid plate (3×6m), and then for each motor (unloaded) the electrical parameters are measured in certain rotation speeds operation.

It must be mentioned that the motors were made in 1997 by Electroputere - Craiova, and the diesel - electrical locomotive was for the second time in general reparation process.

During these tests a high frequency noise occurred (90 - 95dB), thus is not possible to detect which of the motors produce the higher noise level. In order to realize the thermovision evaluation, it was necessary to step near the electrical motors on the metallic rigid plate, and low vibrations were observed.

The two motors were successively connected to the energy supplying system, and it was determined which of the motors produce the metallic rigid plate's vibrations. This motor was separately scanned by using thermovision.

It was observed that even for low rotation speeds the opposite traction side bearing works in high temperatures range 82,9 - 87,3°C (Figura 7). Therefore the practice internship supervising teacher addressed to the technical team collegial recommendations to replace this bearing.

During the replacing operation high rate wear of the opposite traction side bearing was observed. After this bearing was replaced, by using thermovision it was observed normal temperature range 45,4 - 50,3°C (Figure 8) for low rotation speeds (Al Isber, 2013)
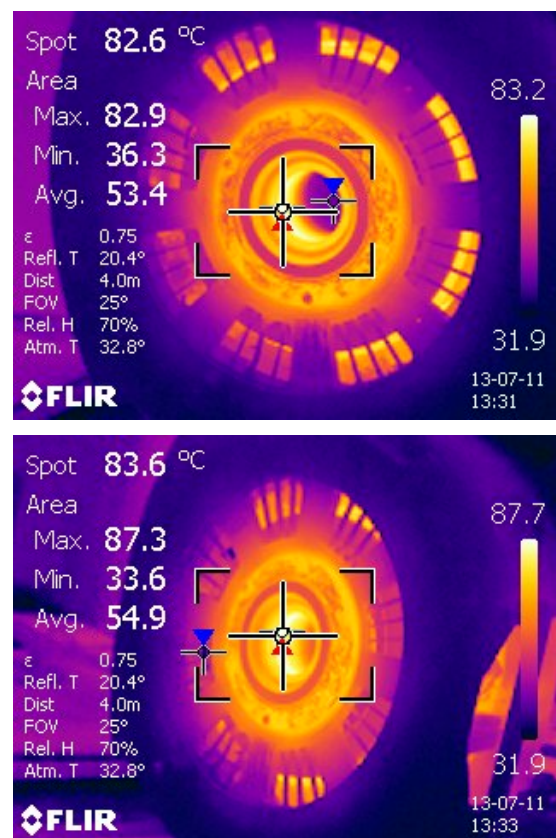
Figure 7. High temperature range 82,9 – 87,3°C of the opposite traction side bearing working in low rotation speeds

17
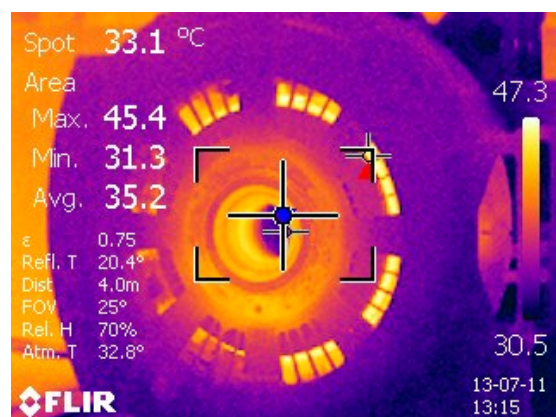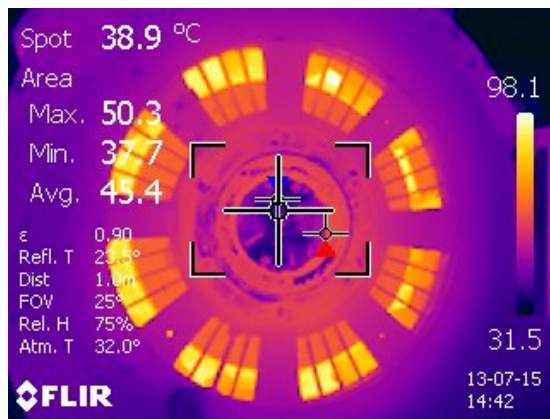
Figure 8. Normal temperature range 45,4 – 50,3°C of the opposite traction side bearing (new bearing) working in low rotation speeds
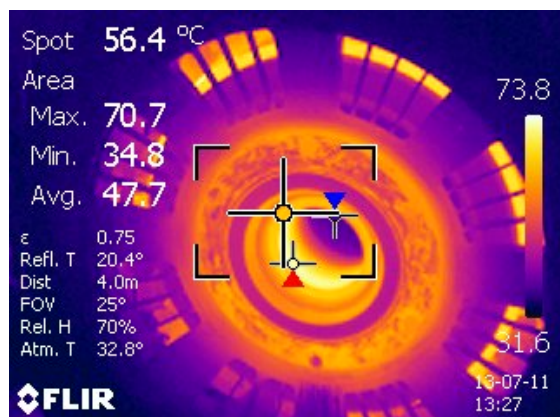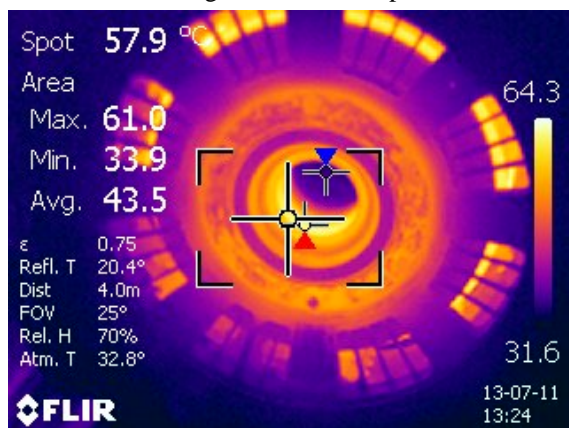
Figure 9. Normal temperature range 61 – 70,7°C of the opposite traction side bearing (new bearing) working in highest rotation speeds

After this bearing was replaced, by using thermovision it was observed normal temperature range 61-70,7°C (Figure 9) for highest rotation speeds, thus proper operation temperatures were observed (Al Isber, 2013).

CONCLUSIONS

In order to realize industrial technological practice internship and to elaborate the Industrial Technological Practice Internship Rapport concerning experimental research on Thermovision applied for studying the electromechanical transmissions operation, University of Craiova signed special Collaboration Partnership Protocols with three representative industrial companies in Craiova: SC Cummins Generator Technologies SA - Craiova; SC POPECI Heavy Equipment - Craiova; SC RELOC S.A. Company - Craiova.

The Industrial Technological Practice Intern-ship Rapport presents the most relevant thermo-grames obtained during experimental researches concerning both several new or old electro-mechanical products, and maintenance aspects, too.

The thermovision reserch was focused on interdisciplinaries concepts concerning all the stages of electromechanicals produces making: desinging, technological making process, assemling operations, quality control, preventive / proactive maintenance.

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http://www.flirmedia.com/MMC/THG/Brochures/T820264

www.micronix.ro

http://www.flir.com/thermography/

https://en.wikipedia.org/wiki/Thermograph

SOME ASPECTS CONCERNING THE USE OF GEOSYNTHETICS FOR SOIL EROSION CONTROL AND LANDSLIDES STABILIZATION ON SIDE SLOPES

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Abstract

The paper aims to present a short review regarding geosynthetics use for soil erosion control, as well as a case study about a landslides stabilization on side slopes using a modern solution based on geosynthetics in Galaţi area.
The use of geosynthetics for soil erosion control and landslides stabilization, but not only, in close connection to environment protection, is being widely recognized mainly in the developed countries in the last years. As it is known, the geosynthetics have six main functions, namely: filtration, drainage, separation, reinforcement, fluid barrier, and protection. Particularly, in terms of soil erosion control, as well as mainly for landslides stabilization, there are used geogrids for soil and land reinforcement.

Key words: environment protection, geosynthetics, land reinforcement , landslides stabilization, soil erosion control.

INTRODUCTION

Landslides and soil erosion hazards exist in Romania, due to the presence of hilly terrain, steep ridges and ravines underlain by unstable geology and overlain by soils which have low carrying capacity for structures. The slope and soil of a hillside are generally balanced with the amount of precipitation, vegetative cover and the underlying geology.

However, hillsides are constantly in motion, due to gravity and the effects of weathering and erosion. Any time the load on a susceptible hillside is increased or the stabilizing vegetation altered, erosion or landslide can occur. These disturbances can also increase surface water runoff and affect water quality through erosion and siltation (Axinte, 2010).

Developments in these hazard areas can frequently result in private and public costs, either for repairs to structures, roads or other facilities or for protective measures to prevent future damage. Development in areas of landslides is also more expensive than development in flatter, more stable terrain. Sewer and water lines and roads may also require special engineering in these sensitive areas.

Landslide and soil erosion hazards can be reduced or eliminated by regulating development to ensure slopes prone to severe landslides are not destabilized. Especially important is regulating development in areas where landslides have actually occurred and where severe landslide hazards exist. When development is allowed on slopes, it must be carefully engineered and sensitively placed.

For reducing the costs of the landscaping slopes using local materials, we have available geosynthetic materials that, in time, prove to be more environmentally friendly compared to metal and concrete.

A geosynthetic material is made of textile materials. In manufacturing geotextiles, elements such as fibers or yarns are combined into planar textile structures (Holtz et al, 1997). The fibers can be continuous filaments which are very long thin strands of a polymer or staple fibers, which are short filaments, typically 20 to 150 mm long. The vast majority of geotextiles are either woven or nonwoven. Woven geotextiles are made by weaving process similar to textile clothing. Nonwoven

textile manufacture is a high-tech process in which a synthetic polymer fibers or filaments are continuously extruded and spun, blown or otherwise laid onto a moving belt. Then, the mass of filaments are either needle-punched, in which the filaments are mechanically entangled by a bed of needles or heat bonded, in which the fibers are welded together by heat and/or pressure at their points of contact in the nonwoven mass (Sofronie, 2002).

Geosynthetics have six primary functions, namely: filtration, drainage, separation, reinforcement, fluid barrier and protection. Geotextiles are used as filters to prevent soils from migrating into riprap and other armor materials, while maintaining water flow, in coastal and stream bank protection systems to prevent soil erosion. Geotextiles or geocomposites can be used as drainage media by allowing water to drain from or through soils of low permeability. Geotextiles and geogrids can also be used as reinforcement to add tensile strength to a soil matrix and thereby providing a more competent structural material. In addition to the primary function, geosynthetics usually perform one or more secondary functions (Moldovan, 2010).

MATERIALS AND METHODS

Disposing of geosynthetic materials, local materials and working methods of the specialized papers we developed a project as a case study for a landslide in Galati county.

Location where was reported the slippage is on the slope terraces near Siret river, train route Catusa-Smardan , Catusa Valley in the Sidex Galati area.

When the execution of geotechnical studies started, slope instability was at high degree, especially in the middle and bottom, where it has been affected over time by powerful landslide phenomena that had affected the railway at the lower half of the slope.

After drilling and on-site research, we found that the slope had been rehabilitated in the past, but due to infiltration, rainfall and soil layers identified, landslide occurred again.

Identified soil layers were:
1. Filling – $\gamma = 17$ kN/m^3, $\phi = 25°$, c = 30 kPa/cm^2;

2. Dusty clay - $\gamma = 20,3$ kN/m^3, $\phi = 17°$, c = 20 kPa/cm^2;
3. Moistened loess - $\gamma = 20$ kN/m^3, $\phi = 10°$, c = 10 kPa/cm^2;
4. Clay dust - $\gamma = 20,3$ kN/m^3, $\phi = 17°$, c = 20 kPa/cm^2;
5. Dusty clay - $\gamma = 20,3$ kN/m^3, $\phi = 17°$, c = 20 kPa/cm^2.

Drainage system and support in the studied area was strongly affected by the slope sliding. Analysis and mathematical modeling of losing stability of the slope was performed using a set of computer programs developed by GeoSlope - Canada.

Mathematical modeling has searched to reproduce, as far as good geological structure of the terrain geometry and stress conditions.

Determination by indirect methods specific geotechnical parameters of the foundation soil immediately before the time of transfer was made considering the massive geometry taken before failure, the limit equilibrium conditions and calculating safety factors of stability for a wide range of geotechnical parameters, are in specific loess soils heavily moistened.

The stability was analyzed near slip area by the following assumptions:

1. Slope geometry taken prior to disposal and the water table located at the railroad drain and groundwater level measured in geotechnical drilling after release.

2. Slope geometry after applying the solution resulting from the project (designed drainage system functioning) adding static and earthquake stress may result from the specific area.

First and second figures represent the two possible methods for arranging the landslides. Considering the loads exerted by the railway line, used for industrial transport and the safety to be provided by the paper, we chose in Figure 1a as a model of rehabilitation.

The third figure shows the arrangement of geosynthetics in the filling and the filling disposed as from the natural terrain of the valley.
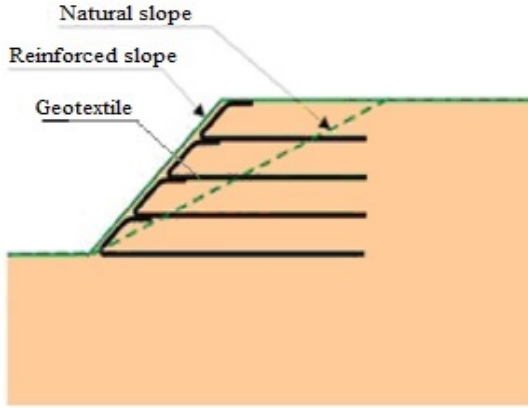
Figure 1. Reinforced slope type a
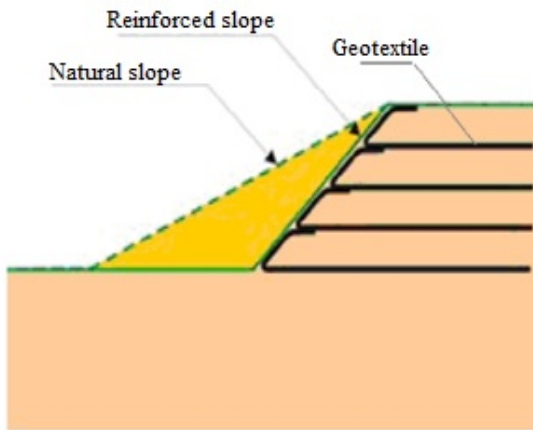
Figure 2. Reinforced slope type b
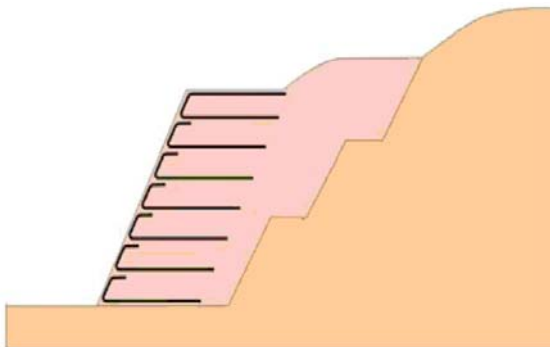
Figure 3. Slope rehabilitation

RESULTS AND DISCUSSIONS

In this context, the rational solution is to apply measures to eliminate the source of water causing excessive moistening of the land and rehabilitate the slipped area. The project foreseen the capture and disposal of surface water resulting from precipitation and prevent raising the groundwater through deep drainage and dewatering results (Mircea et al, 2007). The project had included the following measures:

1. To remove surface water sources using a system of drains that will collect and direct rainwater to existing drains.

2. Make a deep drainage system on the side that does not allow raising the groundwater level to dangerous slip the plans.

3. Restoration of area slipped slope using geosynthetic materials to ensure its stability.

Large permeability of the geotextile filter is desired but at the same time soil particles should be minimized from passing into the filter. The basic requirement of the permeability criteria is that the geotextile filter must remain more permeable than the adjacent soil (Holtz et al, 1997) such that:

K geotextile > K soil

For applications in critical projects, (Holtz et al 1997) suggested that the permeability of the geotextile should be at least 10 times greater than the corresponding permeability of thesoil.

A geotextile clogs if soil particles are trapped within the fabric structure. Clogging can reduce the permeability of the geotextile. Current geotextile-soil retention criteria are generally based on the relationships developed between an indicative pore size for geotextile and grain size of the soil such as the recommendations of (Bergado et al, 1992) as follows:

$O_{95} \leq 3 D_{85}$
and
$O_{15} \geq 2$ to $3 D_{15}$
where:
O_{95} = 95% opening size of geotextile filter
O_{15} = 15% opening size of geotextile filter
D_{15} = diameter of the 15% particle size
D_{85} = diameter of the 85% particle size

For geotextile strength in both separation and reinforcement applications, the formulation of the allowable values takes the following form (Koerner, 1997).

$$T_{allow} = T_{ult} \left(\frac{1}{RF_{ID} x\ RF_{CR} x\ RF_{CD} x\ RF_{BD}} \right)$$

where:
T_{allow} = allowable tensile strength

T_{ult} = ultimate tensile strength

RF_{ID} = reduction factor for installation damage

RF_{CR} = reduction factor for creep

RF_{CD} = reduction factor for chemical degradation

RF_{BD} = reduction factor for biological degradation

CONCLUSIONS

Geosynthetic materials gives technical solutions with a high degree of long-term safety. Reinforced soil with geogrids is considered in geotechnical engineering safe and economic for the following reasons:

- replace the volume and mass of classic materials,
- inverse filters minerals,
- significant savings natural material resources such as energy for extraction, processing, transport and placing,
- does not react chemically with water and ground, may also be used where are sources of aggression, which could degrade traditional materials,
- geosynthetic materials have elasticity,
- laying technology is simple, low labor consumption.

Using geosynthetic materials we minimize ground disturbance during construction by retaining natural vegetation and topographic features such as natural drainage swales and ridge lines, to the greatest extent possible, and by using measures to minimize runoff during development and after construction.

For the case study in Galati, the use of the geogrids with a drainage performance has opened up new opportunities, by increasing the time available during the year to carry out these types of works and reduces the time necessary to compact the various layers, thereby speeding up the overall construction time and minimising the time the railway must be kept closed.

Vegetation had completely covered the slope after six months, thereby returning it to its previous appearance before landslide, but in a fully stable manner.

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GEOTECHNICAL CHARACTERIZATION OF LOESSOID SOILS AND IMPROVMENT METHODS

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Abstract

Collapsible behaviour of loessoid soils in response to water content change is a worldwide problem. These soils are named problematic soils; they can generally be characterised as poor-quality materials. They usually have the potential to show undesirable engineering behaviour. Stabilisation is commonly used to improve the mechanical properties of these problematic soils.The main improvements aimed in the stabilization of collapsible soils are: reduction of supplementary settlement to wetting, increase of shear strength, reduction of permeability. The paper aimed to analyse the geotechnical characteristics of loessoid soils and to present the main improvement methods of these soils.

Key words:loess, collapsible soils, soil stabilization.

INTRODUCTION

Loessoid soils are also known in the scientific literature as collapsible soils. The expression ''soil collapse'' is used to describe a wetting-induced deformation in collapsible soils. These soils have an open structure as the particles are held together by a temporary bonding. If the loess becomes saturated, the material structure collapses and records large supplementary settlements. Normally, collapsible soils have a high porosity and low moisture content.

Such soils are very common in Romania, they are found over some 17% of the area, mainly in Dobrogea, Galati, Braila, etc. In these regions the collapsible soils are responsible for much of the damage in public and private buildings, which has resulted in considerable financial loss. In such situations, the ability to identify the presence of these difficult soils is very important for urban planning.

Design of footings on loessoid soils has been the concern of engineers since the beginning of soil engineering.

It is necessary for designers to take into consideration local economic factor as well as environmental conditions and project location in order to make prudent decisions for considered in many projects.

Stabilisation is commonly used to improve the mechanical properties of these problematic soils. The main improvements aimed in the stabilization of collapsible soils are: reduction of supplementary settlement to wetting, increase of shear strength, reduction of permeability.

MATERIALS AND METHODS

In order to characterize the geotechnical parameters of loessoid soils and its improvement methods we used a series of classifications from the professional literature. The activity in the first stage of the study focused on accumulating published information about the loess classification according to Romanian standards in force and loess improvement methods.

During the second stage of the study, we determined: grain-size distribution, natural density, dry densityand the optimal parameters of compaction of a loess sample from Mangalia.

The grain-size distribution was determined according to STAS 1913/5-85 by sedimentation method.

The natural and dry density of the loess sample was determined according to STAS 1913/3-76.

The compaction test was performed according to STAS 1913/13-83. The optimal parameter of compaction was determined by Standard Proctor method; they are defined by the optimum of compaction moisture content (w_{opt}) and maximum dry density of the soil (ρ_d^{max}).

RESULTS AND DISCUSSIONS

Geotechnical characteristics

In order to characterize a loessoid soil it is necessary to determine the following characteristics:

- Soil composition:
  - Grain-size distribution
  - Chemical-mineralogical composition
- Physical properties
  - Humidity
  - Density of natural, dry and saturated soil
  - Density of solid particles
  - Porosity
  - Plasticity
- Hydric properties
  - Permeability
- Mechanical properties
  - Compressibility and deformability
  - Structural strength
  - Shear strength parameters

These geotechnical properties are determined according to Romanian standards in force.

In order to characterize loessoid soils after the grain size distribution and plasticity index we use the following characterization.

Table 1. Loess classification (after Nicolescu 1981 and NP 125-2009)

Soil type	Plasticity index, I_p	Clay particles, %
Sand silty	$I_p < 1$	< 3
Silt sandy	$1 < I_p < 7$	3 – 10
Silt clay	$7 < I_p < 17$	10 – 30
Clayey silt	$I_p > 17$	> 30

In order to identify a soil as a loessoid soil, by geotechnicaly point of view, has been determined the follow values of parameters.

Table 2. Geotechnical characteristics of loessoid soils (after NP 125-2009)

Soil property	Symbol	M.U.	Characteristics values
Bulk density of soil	ρ_s	g/cm³	2,52 - 2,67
Unit weight of soil	γ	kN/m³	12,0 - 18,0
Unit weight of dry soil	γ_d	kN/m³	11,0 - 16,0
Natural humidity	w	%	6 - 15
Porosity	n	%	40 - 55
Liquid limit	w_L	%	12 – 30
Shrinkage limit	w_P	%	9 – 18
Plasticity index	I_P	%	5 – 22
Swelling pressure	p_u	kPa	0 – 10
Permeability coefficient	k	m/sec.	10^{-4} - 10^{-6}
Supplementary settlement to wetting below 100 kPa	i_{m100}	%	0 - 0,6
Supplementary settlement to wetting below 200 kPa	i_{m200}	%	1 – 4
Supplementary settlement to wetting below 300 kPa	i_{m300}	%	2 – 14
Oedometric modulus	$E_{oed\ 200-300}$	kPa	5000 - 15000
Angle of internal friction	ϕ	grade	5 – 25
Cohesion	c	kPa	10 - 30

One very important property of these soils is the supplementary settlement to wetting below 300 kPa load. This property can be determined in two methods:

- **The simple method:** it consist in running one oedometer compression test a sample at constantinitial water content up to 300 kPa stress; the unsaturated sample is wetted and loaded up to 500kPa
- **Double method:**it consist in running two oedometer compressions test: a) a test at a constant initial water content,

corresponding to the initial natural state of the soil and a test in which the unsaturated sample is wetted under a small load, cause, and subsequently loaded in a zero section condition, close to saturation.

The supplementary settlement to wetting is taken from the difference void ration taken into the two curves under the 300kPa load.
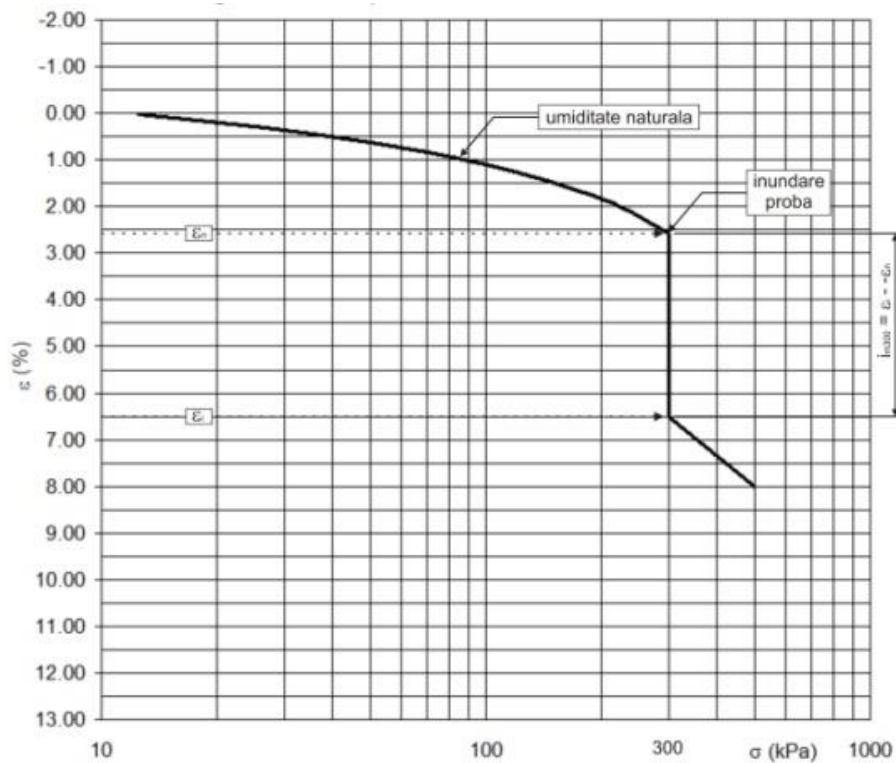
Figure 1. The simple oedometer test (NP 125/2009)
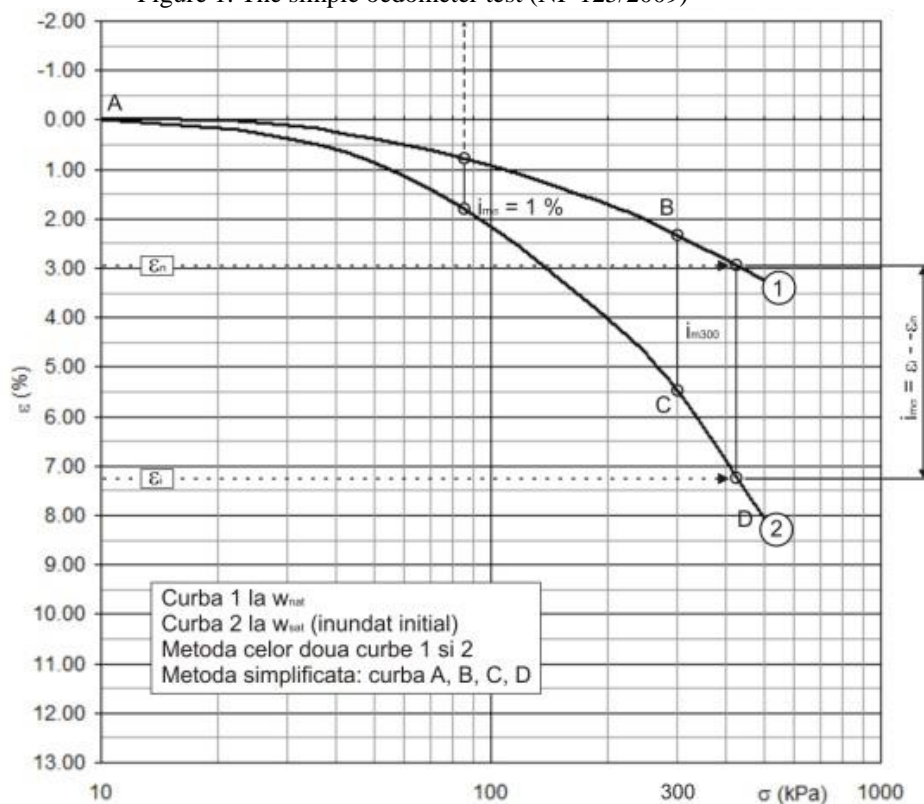
Figure 2. The double oedometer test (NP 125/2009)

Loess – difficult soil

In Romania, for a soil to be considered sensible to wetting (difficult soil for foundation) it must perform one of two criteria from each category of properties: physics and mechanics.

Physic properties:

-Silt fraction 50-80% for $S_r<0,8$;

- Porosity > 40 %

-The index I in the interval [0.1 ; 0,3]; e- the index for pores; e_L – the index for pores at W_L

$$I = \frac{e_L - e}{1+e} \qquad (1)$$

Mechanic properties:

- i_{M300}> 2% is determined in laboratory with the doubles curve:

    1. Natural curve saturated at 300 kPa

    2. Natural curve saturatedinitially.

In the scientific literature, Rukovodstvo, 1977 (according to Soviet norms), depending on the extent of collapsibility under geological load, δ_n, related that loess based are divided into: Type I ($\delta_n<5$ cm) and Type II ($\delta_n>5$ cm). This classification has been accepted in Bulgaria (Pravilnik, 1983) and in some other countries. Loess base Type I is usually <8 m thick, but there is also loess of a thicker collapsible zone, which does not collapse under overburden. The loess base of Type II is $\delta_n> 8 - 10$ m thick, sometimes reaching a thickness in dozen of meters. The value of δ_n is most frequently obtained by laboratory methods, but experience has shown that sometimes there are considerable disparities between laboratory calculated and actual collapses. It has been recommended, therefore, that the type of loess base be determined by experimental wetting in situ (Evstatiev, 1988).

Soil stabilization

The main methods used for the improvement of loessoid soils of foundation depend on the used mechanical work and on the type of the materials that are used to obtain the soils mixtures. They are classified as follows (Ivasuc, 2013):

1. Methods regarding the stabilization of the soils by:

    - physical stabilization

    - chemical stabilization

    - mechanical stabilization

    -thermal stabilization

2. Methods regarding the blocking of the humidity variations: pre-wetting the soil and preventing access of water to the soil.

3. Removal of loessoid soil and replacement with a better soil.

Physical stabilizationis done by the modification of the granulometric composition of a soil by mixing it with another soil. The best or optimal granulometric mixture consists of gravel, sand, silt and clay, which under the concrete natural conditions and way of applying, has the best strength and resistivity in the compacted state. Such a mixture is mostly used in road. Laboratory studies have shown that the strength parameters of the mixture are substantially improved after the addition of small quantities of binders (Evstatiev, 1988).

Chemical stabilization is done by altering the soil structure by mixing it with some chemicals: cement, lime, fly ash, bentonite. Stabilization using cement, lime and some waste materials. This method is most widely applied in road construction. Studies have established the optimal percentages of the binding materials, the mechanism of formation of strength and the strength and technological performance of loess-cement mixtures. Investigations have also been carried out to replace cement by residual ash from cement plants and by activated fly ash from thermo-electric plants (Evstatiev, 1988).

Mechanical stabilization is done by application of surcharge pressure. This group comprises the methods whereby an increase of the density of loess is achieved with the ensuring elimination of collapsibility, reduction of permeability and greater bearing capacity. This is realized under the influence of static or dynamic forces.

Huge masses of compacted loess are used for road embankments, earth dams, various water irrigation facilities, levels and back embankments in civil engineering. Compaction proceeds in optimal moisture content w_{opt}until the attainment of the standard density.

Thermal stabilizationis a treatment realized by burning the soil at temperatures higher than 300-1000°C.The fuel mixtures are burnt in

closed boreholes under pressure. The expenditure of air per hour in the case of liquid fuel is 25 m³ per 1 kg of fuel on the average and in the case of gas fuel it is 10m³ per 1 m³ of gas. In a borehole with a diameter of 0.15-0.20 m a stabilized soil column with a diameter of 1.5-2.0 m and depth of 8-10m can be built in the course of 8-10 days. Usually the stabilization is done in groups of 12-15 boreholes. Loess is burnt at a temperature of 300-1000°C whereby its collapsibility is entirely eliminated and its bearing capacity greatly increases (Evstatiev, 1988).

Methods regardingthe blocking of humidity variations. In loessoid soils geomembranes are chiefly used in water irrigation construction, in building water reservoirs and enhancing the impermeability of the concrete revetments of the canals. Observations have been made for many years on the durability of the screen depending on the kind of polymer, the thickness of the membrane and the soil and climatic conditions. Geomembranes are expected to be still more widely used in the future in combating collapsibility and filtration leakage of loess soils (Evstatiev, 1988).

Removal of loessoid soils and replacement with a better soilthis group includes several

methods in which part of the collapsible surface layer directly under the foundation or in depth is excavated and replaced by some other suitable soils or materials. The ground becomes a non-homogeneous medium and the interaction between the foundation, the improved and unmodified loess is of particular importance for its bearing capacity. In this way the way the danger of collapse of the loess layer situateddirectly under the foundation where the stresses are thegreatest is eliminated. Replacement in depth is accomplished by excavating the entire collapsible layer with a scraper or in some other method and introducing with suitable material (Evstatiev, 1988).

Geotechnical characteristics of Mangalia loess
According to STAS 1913/5-85, the grain size distribution (Figure 3) is composed of 20% clay, 60% silt and 20% sand.
In order to determine the optimal parameters of compaction the Standard Proctor test was performed on Mangalia loess; optimal humidity of compaction =13.89%, maximum density of dry soil = 1.93. These characteristics have been determined from Proctor curve (Figure 4).
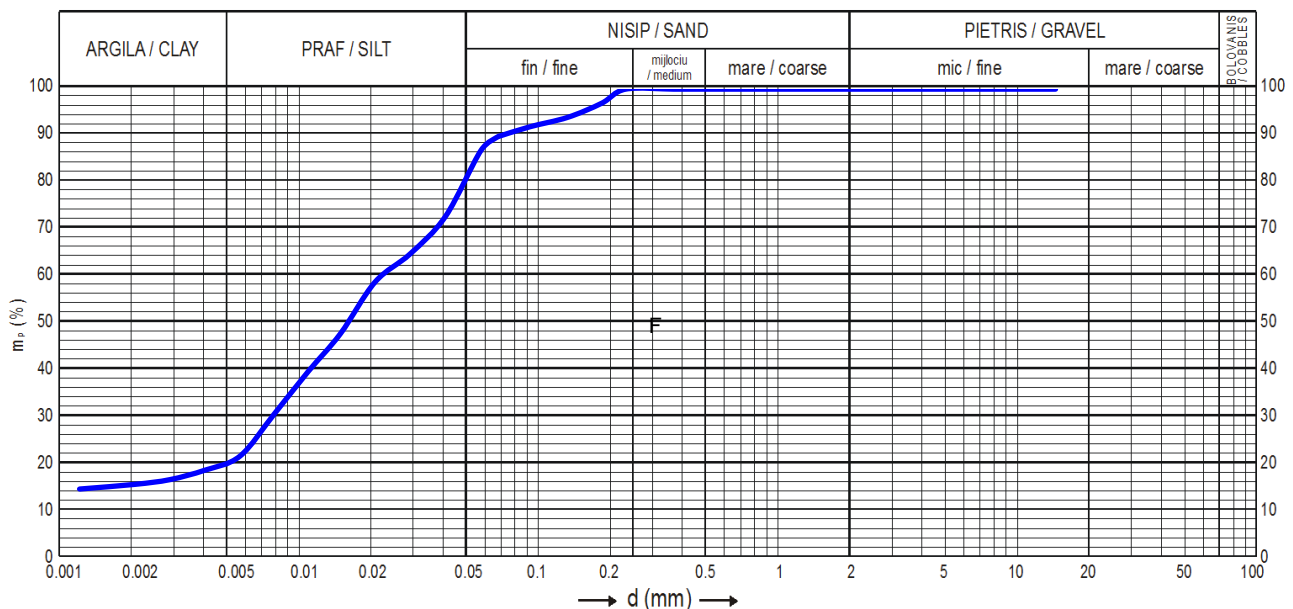
Figure 3. Grain size distribution of a Mangalian loess sample
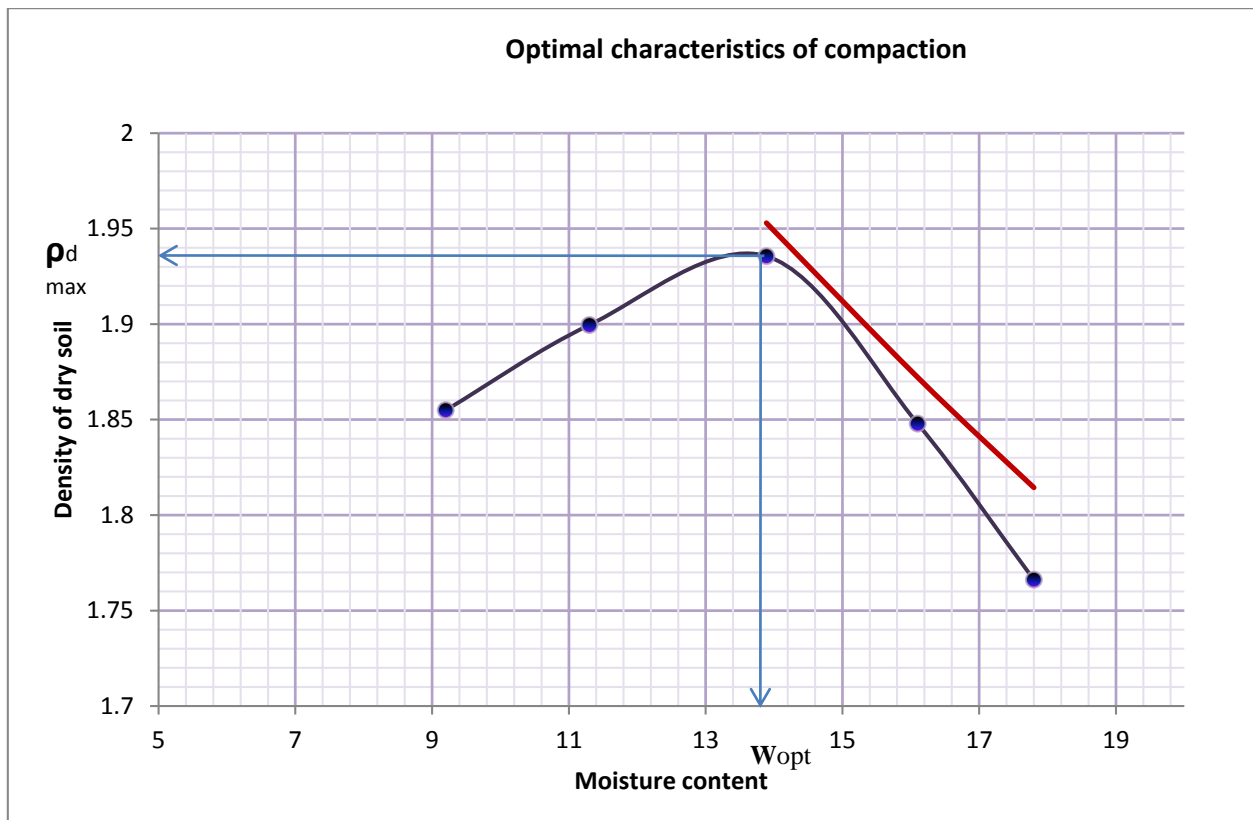
Figure 4. Optimal characteristics of compaction

In our case an approximation of supplementary settlement to wetting below 300 kPa load can be made using only the parameters of humidity according to the follow relation:

$$i_{m3oo} = -0,48\omega + 10,85 \qquad (2)$$

For Mangalia loess, we used the relation 2, using the optimal humidity with the following value: 13.89% and was resulted $i_{m300} = 4.17$ % which is making the analysed soil to be part of soils sensible to wetting (collapsible soils).

CONCLUSIONS

This paper serves the purpose of reviewing some current practices and points out successes in modifying loessoid soils.

The supplementary settlement to wetting corresponds to a particular behaviour of loessoid soils.

Loessoid soils are one of the most significant ground related hazards found globally.

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MANAGEMENT PARTICULARITIES IN LAND RECLAMATION FIELD

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Abstract

The author treats the particularities of land improvements area from the perspective of management science. This article aims to define the land reclamation works, specific issues and foreshadows some solutions and approaches from a managerial point of view meant to internalize the added value and competitive advantage.

In the author's opinion, capitalizing the vast managerial experience from the last decades produced significant scientific accumulations regarding management of an organization based on concepts such as those related to performance, quality and environmental protection, etc . Therefore, a modern approach in tune with these requirements, makes the difference between a building well designed, efficient, economically profitable and one that is developing without perspective and without concern for control, performance and efficiency.

At the end of the article the conclusion is that a quality management applied in the field of land reclamation works is a prerequisite for success. In order to achieve a higher performance there is a severe need for management.

Therefore, management is the qualified process exercising the planning, organizing, coordinating, training and control without which you can't provide decisions, so necessary, and, also, through which organisations from land reclamation domain are fulfilling their specific missions .

Key words: decision making, land reclamation works, management, organization, sustainable development

INTRODUCTION

Through land reclamation works we understand the works made for the fields meant to protect, conserve and improve it. These targets sustainable development which must take into account the needs of this generation and of those who are to come, to use as much as possible a "green" technology of land improvements and at least try not to bring important changes to the area. These works aim to provide a satisfactory agricultural production and where possible, increase it. Land reclamation specialist must identify the land issue which makes it less profitable for agriculture and come up with effective solutions that have a low environmental impact. Solutions that produce serious and irreversible damage are not an option. These

works are performed, usually in rural areas, area of special importance great for society not only because of its dominant share but especially for its outstanding features. This space should be helped to develop using our science results but also to keep their ethnographic characteristics. In order to do that we need well defined projects,organization, capable leaders, coordination, a verification system and a efficient communication between land reclamation engineers and land lords, all these aspects are provided by a solid management. An agricultural land may have many flaws. The three issues that land can encounter, and which are found in our country as well, are:

(i)- the excess of water – which may may come from rainfall and \ or from groundwater located

at a shallow depth, difficulty which can be remedied by draining drainage works. Another cause of excessive water are floods, situation which is remedied with works on rivers and damming. This situation is to be found on about five million hectares in our country, the land with small slopes (1-3%) and a high content of clay. Factors that cause water excess are both natural and anthropogenic. After draining the soil is more ventilated, microorganisms activity can take place in good conditions, physical and hydro conditions improve along with soil structure and its permeability. The plant root system can develop normally and healthy, chemical fertilizers are no longer washed away, hydrophilic plants are controlled, pests and diseases specific to areas with excessive water are prevented. (Sorin Cimpeanu, I. Plesa, 2001)

(ii)- water deficit which is caused by climate change in the last years is a problem increasingly harder to neglected, problem that can be controlled by applying a rational amount of irrigation. In irrigation it must be taken into account soil-water-plant-climate relationships and is necessary to understand the penetration processes, storage, movement, and loss of water in the soil. It also must be considered the plant vegetation stage depending on which it should be given a more or less amount of water. The best way to find ground water requirement is when the engineer goes on the field, takes a soil sample and he determines the water deficit in a laboratory. Ideal humidity range for the plant is between minimum threshold and field capacity thresholds which differ depending on soil texture. Irrigation norm is determined by the consumption and water loss of the plant, the initial and final water reserves in the soil, rainfall and groundwater contribution. Watering methods are determined by the ground level and the culture which is planted. The most common methods are sprinkler irrigation, dropwise and for rice using submersion. (Berca M. 2006)

(iii)- soil erosion - due to solar radiation and gravity on the Earth's crust occurs an inexhaustible kinetic energy which is keeping the soil in a constant transformation, both water and air contributing to this phenomenon. Agriculture shows interest mostly for the first 20-30 centimeters which represents the active layer of soil, layer where there are most of the nutrients that the plant needs. Annually in our country are lost an average of 189 tons / square km. This phenomenon is produced on slopes and in our country about five million hectares are affected by erosion and the phenomenon is strong on 1.2 million hectares. Obviously the most significant soil losses are recorded in mountain and hill areas, areas that have been deforested, irrational expolatete and on lands which although it was found that the soil erosion process manifests no action was taken. The main factors influencing soil erosion are slope of the land, slope length, vegetation and torrential rains. Methods to control this phenomenon are from the simplest such as plowing parallel with level curves, to their most complex and expensive such as embankments. (Constantin E., Maracineanu Fl., 2005)

Land reclamation works have their characteristic features:

-long operating life- tens even hundreds of years if exploited rationally
-high specific investment-With values that can reach up to eight - nine thousand euros / hectare
- the investment is recovered in a longer period of time- period can be up to 10-20 years
- have a complex character- must take into account all environmental factors when designing a work so as not to decrease the quality of water, soil or air in the area
- a work is done, usually in several agricultural areas - to decrease and split the investment and maintenance costs at the same time, for that it takes a collaboration between land lords
- rapid evolution in the concept design of facilities- when a new technology appears is adopted by the design engineers

- growth rhythm- the land reclamation works in the world are very sustained, unfortunately in Romania is not. (Dobrescu N. 2001)

Management is a science of its own. The most known and developed management science component is represented by the company management. The essence of management is represented by the study of relationships and management processes. The reason why the management field places a great importance to the company is because the firm is the environment where the management was born and in which most people of any country are operating. Management processes are characterized by the fact that some of the workforce acts upon the other party, the majority, in order to achieve a higher achievements. In practice management is based on two activities: the first is scientific management based on knowledge and appropriate application of technical and methodological elements provided by management science and the second part of the work is based on empirical management personality traits of the leader, the experience and the leaders intuition. Before the emergence of management science skills were the exclusive part of management work.

MATERIALS AND METHODS

Management process, according to Ovidiu Nicolescu and Ion Verboncu, can be divided given the nature of the tasks involved in his development and how to achieve in five functions:

1) Forecast - prediction is the management function that allocates resources according to an prediction on which the company can expect. The results are divided into three categories:
forecasts, are approximate and cover a 10 years horizon, not mandatory;
plans, have a horizon ranging between five years and one month and accuracy is inversely proportional to the horizon, are mandatory, basis underpinning the incorporated activities;
programs, their specificity being a low horizon thus a high degree of certainty. If the forecast function is exercised properly within the organization will be noticed many improvements including: a systematic performance increase, a judicious allocation of resources, uncertainties and risks are reduced, and last but not least, the manager develops a forward-thinking, forward-looking and innovative way of seeing things.

2) The organization - Is the management function that establishes who and how they will do the job so that the company aim will be brought to the expected end.
In the organization delineates two main subdivisions: overall organization, part exercised by senior management of the company that is materialized by establishing the organizational structure and information system and organization of the main components of the company, is the component in which predominates quantity and is performed by the middle and lower management. Within a compani can be distinguished two types of organization, the official one, clear, exact, known as formal organization and organizing that occurs naturally within each group, which is materialized through relationships, known as informal organization. Between these two there must be a balance for the organization to carry on the work under good conditions.
3) Coordination - It is represented by the economic agent dynamism reflected entirely in predictions and organizational system. To ensure effective coordination of proper communication is essential at all levels of management. This takes two forms : bilateral, conducted between a manager and a subordinate or multilateral, between a manager and several employees in the meetings. Coordination is the process by which the issuer, in our case the manager, send a coded message to one or more receivers ensuring that his subordinates understand the message, requesting feedback from them. „Coordination represents a set of processes through which work activities are harmonized, in order to achieve goals and avoid overlapping or non-coverage of important areas of action." (Zecheru & Nastase, 2005)
4) Motivation - represents the set of processes wherewith the execution staff is convinced to carryout their duties. The instrument of

entrainment is represented by the motivation brought to the employee which can be positive or negativ. The positive one is based on the amplification of staff satisfactions and the negative one is based on threatening the staff with the reduction of their satisfactions if the targets proposed are not achieved. Usually positive motivation is being used, because it is more efficient. A good leader is also a keen observer. He must deduce which are the impulses and factors that lead to higher efficiency of the employees and try, as much as possible, to provide them the necessary. If the employees are working in an environment that they enjoy the results will not delay to appear. The two main motivations to which employees respond positively are economical, depending on the effort made within the organization they receive salaries, bonuses and other benefits, and the second motivation is represented by merit recognition motivation at least as important as the first because, as Abraham Maslow observed in his famous pyramid of human needs, esteem and membership are more important needs than the physiological ones.

5) Managerial control - closes management process comparing obtained results with the objectives. It involves four phases: Measuring achievements; comparing achievements with the goals and standards established initially, highlighting deviations produced; determine the causes which led to any breaches identified and applying of the necessary measures. This is a mandatory function organized and led by the tactical and operational management. Control prevent irregularities and fraud, protects information assets and the quality and accuracy of records is very high. An important feature of this function is represented by the flexibility, feature that leads to a dynamic respond to problems that can occur within an organization. For increased efficiency, the evaluation-control function must be an ongoing preventive and corrective evaluating cause-effect proces. (Vasile Zecheru, 2005)

Management system within an organization has *four main subsystems* :

1) Decision Making – the main subsystem of any management system. Its main components are: the leader with the qualities, knowledge and skills that he acquired in time, developed decisions, decisional environment, issues that need to be solved and decision criteria for evaluating alternatives. The essence of leadership is the decision-making system output. To make a decision the manager can address the situation in two complementary ways, the first and most common is the rational way and the second one is an intuitive path that requires much imagination and divergent thinking from the manager.

2) Organizational – is the result of the organizational function. All the organizational type elements that ensure the framework, combining, splitting and functionality of the work processes in order to achieve the expected results. Forms of organization may be formal, firm's elements being established by the Regulation of organization and functioning or informal represented by elements of organizational character and human relations.

3) Informational system – both people and information are the most important resources for management. As the quantity and quality of information generated and used increases, the evolution and complexity of organizations is growing. A major contributing factor is that the informational system grows from day to day, computers enhanceing their performance exponentially. All the informations obtained are processed to capitalize their full potential.

4) Methodological – the subsystem which brings together all the other systems, methods and techniques used within an organization in order to achieve high performance. Most common methods are: management through objectives, focuses on a rigorous formulation of the objectives and strictly monitoring the steps to fulfill them . Management through budgets, is used in many cases with management by objectives and is the method with which to establish the objectives and modalities of action according to the financial capital that the organization is willing to make available to achieve those objectives. Management through projects, is based on a temporary organizational structure, in order to achieve defined goals in a given period of time, approaches based on a strong innovative character. The main person in this type of management is the project manager

who must achieve the objectives in good condition and in the period of time established. Management based on the product represents the management system responsible for a specific product or product family. The manager has a relatively autonomous responsibility within the organization and it must assume responsibility for the product's evolution as far as capitalization. In land reclamation projects can be applied any combination of these methods in order to achieve good results. For various stages of construction can be applied different management methods and, in my opinion, If you use a balanced combination of these four methods you cand achieve the results you want. (Vasile Zecheru, 2005)

RESULTS AND DISCUSSIONS

In the following I will be presenting the applicability of the management functions in a land reclamation project. Before a land reclamation project work strats, studies are made regarding the climate, the flows that are brought by rainfall and aquifer, the soil type, topography of the land, and anthropogenic factors that intervene on that agricultural areas so that the land problems that must be combated be foreseen as accurate and the efficiency of the arrangement to be as high. Works once started must be conducted in a logical order according to a well established plan from the beginning so that people, resources and equipment to be used to achieve maximum efficiency, eliminating as much as possible, dead times. Between the designer and the engineer in charge of the execution must be a permanent communication, communication after which they adopt the best solutions. Due to large design and construction periods or the occurrence of some factors that were not initially considered, a project may change and this requires bilateral coordination between the two engineers. If the project is to be operated over a long period of time and the work is to be executed at a great distance from their villages of origin, the workers who are on site need to have all necessary conditions for a decent life, from basic needs such as food, water, electricity, and temporary housing and places designed for their relaxation . At the end of the

week the workers are transported up in their settlements. In the final stage of a land reclamation project, the reception, all involved have the duty to check if they have done their part of the job well. Thus the reception represents all the verifications after is determined if the building project has achieved its purpose. At this stage every organ has his own duty: The Contractor aims that the work completed to correspond with the quality and quantity as prescribed and the work reimbursement to be made only on the basis of actual work in the field. The investor follows the evolution of the project thru his supervisors who always have to check the materials delivered by the manufacturer,all the documentation, records, samples and results of the quality control and have to ensure that the established functional parameters were touched. The designer aims that the work that has been executed under the technical and economical documentation, no change can not be adopted without his approval. The level of responsibility of the manufacturer decreases from the beginning until the end of its reception when his no longer responsible for the work while at the end of the reception the owner has full responsibility for the work. The warranty period for irrigation and drainage works is 18 months.

CONCLUSIONS

Land reclamation works need to be designed and effectively implemented through organizations (institutions, companies, etc...) in which these works to be managed unified and coherent in terms of economic profitability. All of this can not be possible unless the organizations involved in such activities are conducted properly. In other words, the management of such organizations must be a competent and efficient one. In order to maintain themselves on the market, firms, implicitly the ones in land reclamation field must constantly adapt to the needs of the beneficiaries. For organizations in the field of land reclamation and equally for their management, streamline of the work processes, minimizing technological losses and improving their control systems are just some of main action directions. Gradually, such approaches

lead to a more efficient use of all types of resources, labor productivity growth or, generally speaking, such organizations obtain an advantage against the competition in their field of activity. Of course, for all this to be accomplished, the organization itself needs an efficient management team, genuine leaders, who know the precepts of the leadership science, deeply involved in their projects and thus fully motivated to achieve notable results.

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RESEARCH CONCERNING GULLY EROSION EVOLUTION ON AGRICULTURAL LANDS

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Abstract

Gully erosion initiation and evolution on agricultural torrential watersheds, as well as the prevention and their control works, represent a very complex process. Despite the fact that most of the gullies in such hilly areas have been partly or even totally stabilized in the past, today some of them continue reactivating in time, mainly on the gully bed due to several factors, among them being the poor maintenance of the anti-erosion works. The paper aims to present and analyze some practical aspects concerning gully erosion today's evolution from one of the most affected area in Romania by soil erosion and landslides, the Subcarpathians Curvature. The research of the case study was carried out in the spring of the year 2014 in comparison with the reference year 1997in terms of gully evolution on Tatarului Valley.

Key words: land degradation processes, gully erosion, sediments, check dam

INTRODUCTION

Soil erosion, in general, and gully erosion process, in special, affects an important part of the Romanian territory, both agricultural lands and forests. Apart the surface erosion and landslides, gully erosion affects an important part of the Romanian agricultural lands and forests. The most significant types of gullies in the country are the torrents and ephemeral as well as permanent gullies that are present in several locations. Continuously gully erosion development produces important damages to the agricultural lands, human settlements and socio-economic units. Slanic's hydrographic basin is located in Buzau county, in the country's southeast. Buzau County has an area of over 600,000 ha which have a distribution of 19% mountains from the area, hills and plateaus 31% and a vast plain that represents 50% of the Buzau County. Slanic River watershed is a tributary to the Buzau River on his left side and their confluence occurs in Sapoca village. Slanic watershed has an area of over 54,000 ha and a length

represented by 65 km found mostly in the Subcarpathians Curvature. Slanic River represents the Eastern boundary of Muntenia's Central Sub-Carpathians and separates Vrancea Mountains from Buzau's Plain. Buzau area represents an interest to our field of activity and continuously research because there are recorded the most significant soil losses in the country. In Buzau County it has been inventaried a gully erosion network of about 1,000 km, that represents about 1,000 hectares of agricultural lands (Mircea, 2000, 2008). Having in view the complexity of the land degradation processes in the Slanic Valley watershed, a huge interest is represented by several of the sub-watersheds, being mainly located in the low and medium third parts of the watershed, which were taken into study in this paper. In our study we have made a topographical survey on the gully from the Tatarului Valley, which is located on the right side of Slanic River (Figures 1 and 2).
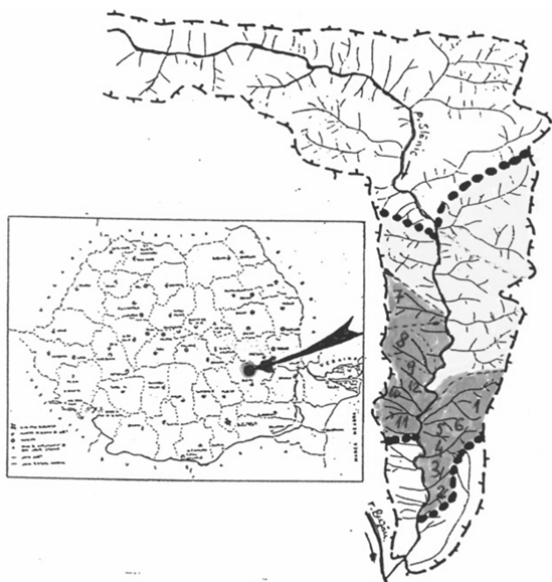
Figure 1 Sketch of the studied area, Slanic/Buzau, Sub-Carpathians Curvature region, Buzau County, Romania

Figure 2 Topographical survey on the gully from the Tatarului Valley, Sub-Carpathians Curvature region

MATERIAL AND METHODS

The field measurements on the studied gully were carried out in the spring of year 2014, in a location situated next to the Soil Erosion and Conservation Aldeni Research Station - Buzau (Subcarpanthians Curvature zone), an area characterized with loamy textured chernozems and mean annually precipitation of about 450 mm, out of which about 350 mm are fallen during the vegetation period, April-September. All these natural features illustrate the influence of slope and land use on soil loss, especially on gullies, being in this way identified the best soil conservation measures.

The most significant gullies in the country are the torrents and permanent gullies, which are present in several locations. As it is known, gullies development on the three main directions - in length, width and depth, has a major impact on environment, either on short or long term. The continuously development of the gullies causes important damages to the environment, in general, to the agricultural lands in special, as well as to the human settlements, watercourses and various socio-economic units, such as reservoirs or hydropower plants, transportation ways etc. According to M. Motoc (1999), gully erosion only contributes by 31% to the total soil erosion in Romania, generating about 36 million tons/year of alluvia. Annual losses of agricultural lands have been estimated to around 2,300 ha. Gullies' evolution in length has become in time more and more important. To better predict the rate of gully headcut advance, so far there have been developed several specific determinist models, out of which can be mentioned: Thompson (1964), Seginer (1966), Soil Conservation Service (1977), Sueddon (1985), Temple (1992), Ichim & Radoane (1994, 1998). Most of the prediction models have generally been developed as regressions (simple and multiple correlations), using the following independent variables: the catchments area at the gully headcut; terraced area, out of the total catchments area at the gully's headcut; annual rainfall measured at the gully headcut catchments; soil features (content of clay) at the gully headcut; gully's length at a certain moment; distance and relief energy between the gully's headcut and the highest altitude in the river basin; valley's slope upstream of gullies' headcut. According to the specialized literature, the rate of gully headcut advance varies very much from a region to another, as well as within the same area. In Romania, the annual rate of gully headcut advance varies as follows: Colinele Tutovei region, 0.5 – 2.0 m/year (Motoc et al., 1979); Slanic-Buzau region, 1.4 – 5.4 m/year (Mihaiu, 1980), and, respectively 1.75 – 6.70 m/year (Mircea, 2000); Barlad Plateau region, 12.5 m/year (Ionita, 1998), etc.

RISK INDICATORS FOR GULLY EROSION DEVELOPMENT

This category of indicators is a very important and complex one for the gully development. Generally speaking, natural risk (climate, geology etc.) does mean the probability to occur a certain natural event that produces damages to the people or affects their activities. In the specialized literature concerning water erosion and landslides there is frequently used the notion of risk rather than hazard. There are used for gully erosion the following indicators:

- *gullies advance in length*, (m/year);
- *gullies development in width*, (ha/year);
- *gullies development in volume*, (m^3/year).

In Romania, M. Motoc (1999), has proposed a series of *risk indicators* concerning gully erosion, as follows:

1. *Rate of fragmentation of gullies' watersheds and jeopardize of some social-economic objectives located upstream of gully headcut,* such as: civil constructions, transportation ways, water or gas/petrol pipelines, etc.:
- it is calculated by the ratio $R_{ar}/S_{r\ vf}$, (m/year/ha),
where R_{ar} is the yearly rate of gully headcut advance, in m/year, and $S_{r\ vf.}$ is the gully headcut's watershed, in ha.

2. *Risk of gully development in width*:
- it refers to the yearly rate of lands loss, in ha/year;

3. *Risk by inundation and/or siltation of the lands or some social-economic objectives downstream*:
- it does refer to the annual damages, financially evaluated, that are produced downstream of gullies on agricultural lands or even to some social-economic objectives.

ANTI-EROSION WORKS

Human intervention in erosion works must answer in all cases to the specific conditions of each unit, being necessary studies and an elaborate research on the development of erosion and river network, both under natural conditions and after improvements. In an arrangement work of a hydrographic basin the volume necessary to combat soil erosion may vary from 20% to 60% depending on the importance of the objectives that must be protected. The gully from Tatarului Valley has a concrete check-dam of 3.5 meters high, which was identified at the distance of 32 meters from gully's headcut (Figures 3 and 4). This check-dam was not silted on its first 1.6 meters in the year 1997, and today - because of its drain holes that height has grown to almost 2 meters. In those seven years the length of this gully grew up upstream rapidly from 32 to 43 meters (Figures 3), despite the fact that the discharge of the gully's headcut has been decreasing a little bit in time.

Figure 3 Gully's headcut of Tatarului Valley, Sub-Carpathians Curvature region, Buzau County, year 1997

Its evolution would have been much greater in time if the gully and its side walls well as the surroundings wouldn't have been forested with acacia species. The acacia trees have spread their roots on the entire perimeter, which caused in this way a slower evolution of the gully, as it can be seen in Figures 2.

Also, as it can be seen from the Figures 5 and 6, the gully's width has not been modified significantly in time. Tree roots have successfully stopped the evolution of the gully on its width. One aspect that should be mentioned here, that applies to Tatarului Valley, but not only, is related to the influence of the size and position of the dam's drain holes. Through these drain holes water discharge have started flowing in large quantities washing the alluvia deposited upstream of the check-dam (Figure 3). The dam that was originally fully clogged with alluvia slowly began to be washed and to lose its stability. A factor that helped this phenomenon is the small fragments of wood roots left behind

the dam. Generally many check-dams on the gullies have their drain holes much larger compared to the size of the alluvia that are transiting downstream.
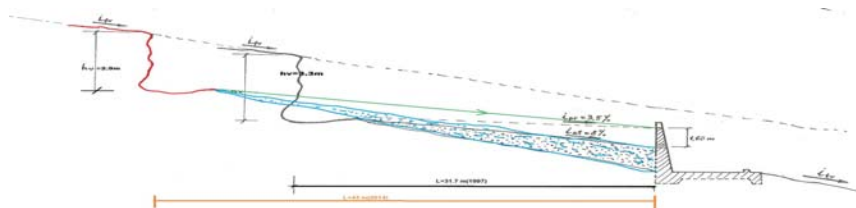
Figure 4 Longitudinal profile in the area of Tatarului gully's headcut, comparison between years 1997 and 2014
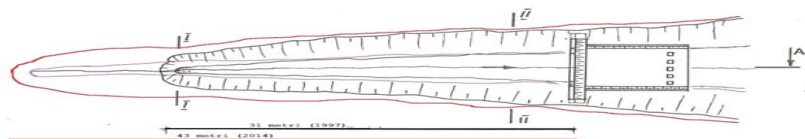
Figure 5 Layout of Tatarului gully's headcut area, comparison between years 1997 and 2014

RESULTS, DISCUSSIONS AND RECOMMENDATIONS

From observations made on Tatarului Valley ravine we have came to the following conclusions and practical recommendations for the design, construction and operation of works made for ravines:

- there are far more effective small height and more frequent transverse works than those that after warping, are creating in some circumstances higher slopes than the natural ones;
- in the first stage of the works, erosion downstream of the dam is more pronounced than the one upstream because the alluvia is deposited behind the dam and the only thing that passes is water with a high kinetic energy;
- the dams are creating low slope areas upstream of them and lowers the kinetic energy of the water but does not prevent the evolution of the ravine to the top;
- apparently dams with small drain holes placed on top of the dam are the most effective, these are the ones that get clogged the fastest.
- longitudinal slope development is uneven between works and is strongly influenced by

the works height, the distance between them, by location and by the nature of the transported material. After its fully clogging, dam's longitudinal slope tends to rise and return to the initial slope of the thalweg;
- to avoid the displacement of the works, both permeable and the impermeable ones, during heavy rainfall, it is recommended afforestation where the work is located and in the surrounding areas.

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GEOLOGICAL CARACTERIZATION OF LOESSOID SOILS FROM ROMANIA

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Abstract

Loess is a deposit of wind-blown silt that blankets large areas of the continents. It is often light brown in color, consisting predominantly of quartz, feldspars, micas, and calcium carbonate. Geographically, loess is extensive in the North American Great Plains, south-central Europe, central Asia, and central East of South America. In Europe, loess deposits are common in areas that lie between the former Alpine and the Scandinavian ice sheets and in regions to the east associated with major river systems. In Romania, loess was described by Gr Stefanescu in 1895 and the aeolian origin of the loess was stated for the first time by L. Mrazec, in 1899. Loessoid soils are very common in Romania, mainly in Dobrogea, Galati, Braila; they are found over some 19% of the area (Popescu, 1965). The aim of this paper considers the main topics of loess distribution, different hypotheses of its origin and geological characterization of these problematic soils.

Key words: loess, Romania, aeolian deposits.

INTRODUCTION

The loess term was added since 1903 by Charles Lyell, and it comes from word of German origin "lose" or "loss" defined as "loose, porous, brittle". Loess is a sedimentary rock, unconsolidated, quaternary age, home wind, yellow-gray, with a porous appearance, made mostly of silica dust and clay.

Loess soils and loess deposits are very sensitive to wetting due to high porosity: 40-50%. If intense moisture, compaction increases relatively sharply, gaining character of collapse. Loess deposits represented typical sensitivity to wetting was formed by wind action, which moved microparticles of dust from arid to semi-arid regions, depositing them over existing vegetation. With time, the rotted vegetation layer form vertical ducts which causes a much higher permeability in this direction and a very loose structure.

The spread of the loess deposits range from 5% in South America, 7% in Europe, to 16% in Asia. In Romania, loess covers 19% of the area (Popescu, 1965). On average, in Europe, the thickness of loess deposits is 30-40 meters, while in Asia can reach up to 400 meters.

MATERIALS AND METHODS

In order to analyze the geological characterization of loessoid soils from Romania we used a number of experimental studies from the professional literature. The activity in the first stage of the study focused on accumulating published information about the loess formation and loess-like deposits in the world and in Romania.

During the second stage of the study, we have visually examined the characteristics of a loess deposit.

RESULTS AND DISCUSSIONS

Loess formation in the world

Loess is a deposit of wind-blown silt that blankets large areas of the continents. It is often light brown in color, consisting predominantly of quartz, feldspars, micas, and calcium carbonate (Pye, 1987). Geographically, loess is extensive in the North American Great Plains, south-central Europe, Ukraine, central Asia, China, and Argentina (Figure 1).

In North America, loess was derived from both glacial and nonglacial sources (Bettis et al., 2003) but is commonly related to formerly extensive outwash deposits from the Laurentide ice sheet and to the floodplains of large, braided rivers; sections along the Mississippi River valley may reach 20 m in thickness (Oches et al., 1996). The thickest loess deposits are found in the unglaciated regions of Alaska (up to 50 m) and in Nebraska (up to 48 m) where the LGM (Peoria) loess was derived from bedrock sources northwest of the region (Chapter loess).

Loess in Europe

In Europe, loess deposits are common in areas that lie between the former Alpine and the Scandinavian ice sheets and in regions to the east associated with major river systems (Figure 2). Some of the thickest loess sections are related to formerly extensive braided rivers at a time when vegetation cover was greatly reduced (primarily grassland) (Fitzsimmons et al., 2012). Although rarely continuous, some sites have loess and paleosol sequences that extend back into the Early Pleistocene (particularly in the middle and lower Danube River Basin, e.g., at Stari Slankamen in Serbia and at Stranzendorf and Krems in Austria; (Markovic´ et al., 2011). Elsewhere, loess is related to desert conditions, especially the extensive deserts of central Asia where weathered material, transported from adjacent mountain ranges, has accumulated (Smalley et al., 2009). These vast arid areas, and the adjacent Yellow River system, are the source regions for the extensive Chinese loess deposits (Stevens et al., 2013). In north-central China (southeast of the Gobi Desert), loess deposits are extremely thick, up to 300 m in places, and completely cover the underlying topography, forming a loess plateau that extends over an area of 500,000 km^2. It is there that the most comprehensive paleoclimatic studies of loess deposits have been carried out.
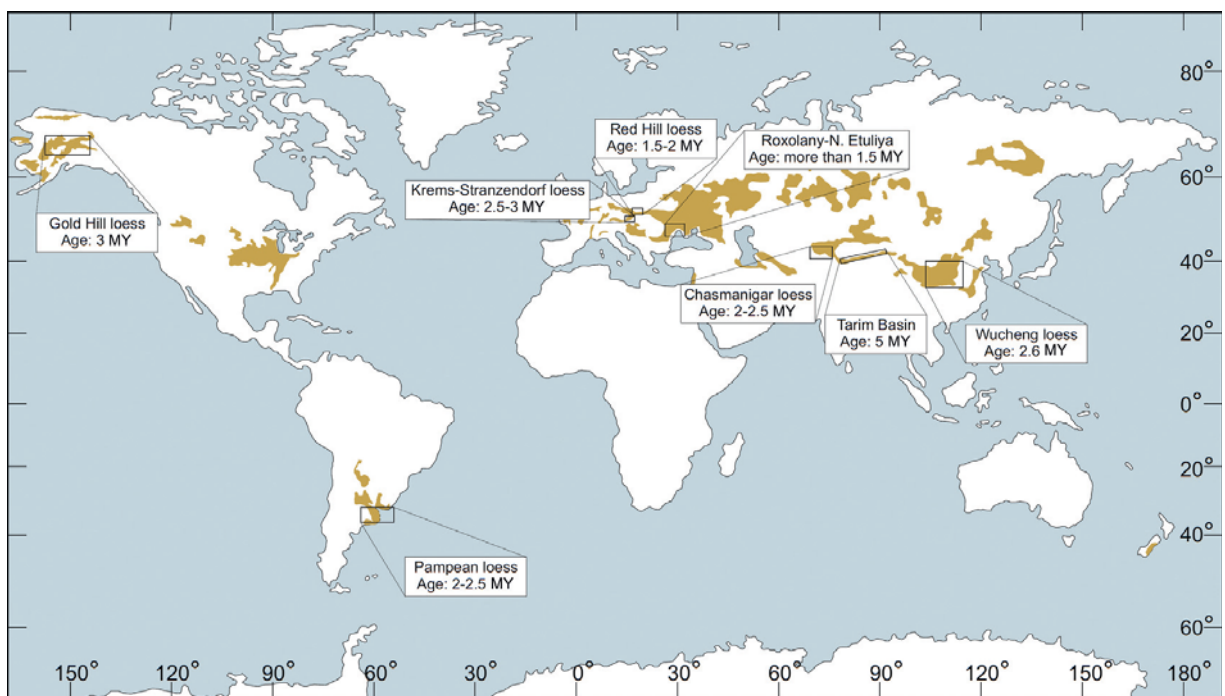
Figure 1. Global distribution of loess deposits. (Varga 2011)
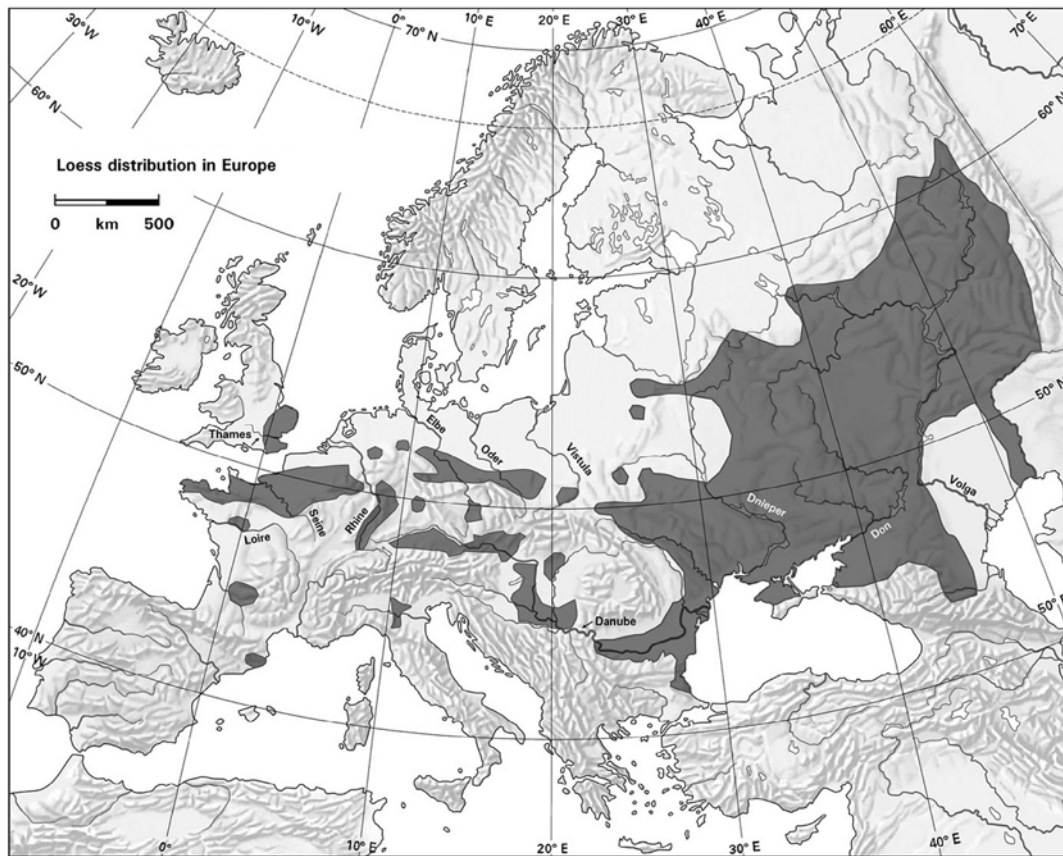
Figure 2. Loess distribution in Europe. Loess distribution is related to the former extent of ice sheets and the distribution of major river systems (Smalley et al., 2009)
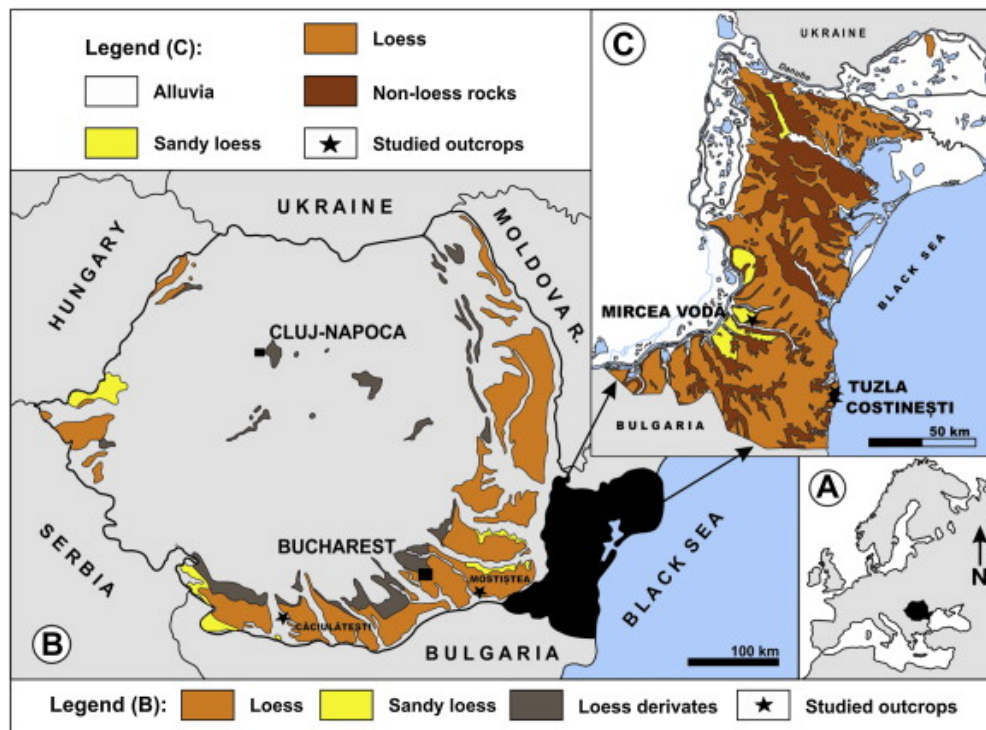
Figure 3. Loess distribution in Romania (Constantin et al., 2013)

Loess in Romania

In Romania, aeolian origin of the loess was sustained for the first time by L. Mrazec, in 1899, in paper "Comunicare asupra loessului din Romania".

The bases of the loess and paleosoils studies there have been set, at the beginning of the XXth century, by Gh. Murgoci and his contributors, Emm. Protopopescu-Pache and P. Enculescu (1908, 1910). They were sustained the Aeolian origin of the loess (the sources were, at last for the eastern part of the Romanian Plain, the alluvia of the rivers which cross the plain), they shown that the red layers from loess are paleosoils and, by analyze of those, "we could deduce the climatic changes from Romania from the age of the loess sedimentation" (Gh. Murgoci, Emm. Protopopescu-Pache and P. Enculescu 1908-1910).

In 1903 Simionescu shown that in Moldavia, between Siret and Prut rivers, the loess-like deposits have alluvial origin (there are formed in the same period with melting of the north-European ice-sheet). In 1908, R. Sevastos studied the loess from Moldavia, consider that it is aeolian deposit formed by sedimentation of the dust brought by winds from Asiatic deserts or from the north-European ice fields.

The loess and loess-like deposits characteristics

In many studies published in the scientific literature there have been made no differences between loess and loess-like deposits, but there were often used the both terms for deposits with different textures. Liteanu and his contributors used, for the deposits from the Romanian Plain, only the term loess-like deposits, with different mechanical composition. Conea (1963) made an paralleled description of the loess and loess like deposits, which we resume below:

The loess:
- unconsolidated, yellow, unstratificated and uniform rock;
- silty texture (with prevalent 0,05-0,01 mm elements), and without coarse

elements;
- high porosity (40-50%);
- with very low or without plasticity;
- carbonates equal dispersed in rock and precipitate as limes concretions;
- favorise the subsidence and is easily to erodate.

The loess-like deposits:
- unconsolidated rocks, with different colors, sometimes with stratifications and various uniformity;
- different mechanical composition (clay sand-silt), with coarse sand and/or gravel;
- various porosity, generally low;
- various plasticity, depending on mechanical composition;
- carbonates dispersed;
- the subsidence and the compaction processes are not characteristics;
- they could be quickly and radical transformed by secondary processes.

The loess has more than 60% particles between 0,01 and 0,1 mm and loess-like deposits have less than 60% of that particles.

In time, there were made textural analyses for the loess and loess-like deposits from main regions of the country and stated that the loess from Romania is similar, as concern the mechanical composition, with that from Eastern and Central Europe (Gherghina, Grecu, Cotet, 2006).

The extent of the loess and loess-like deposits in Romania

Many researchers related that the area occupied by the loessoid deposits is about 40.000 km² and is spread on the interfluves and the top of the terraces from pericarpathian regions: the Romanian Plain, Dobrogea, Getic Plateau, Moldavia, the West Plain (Figure 3). To this there are added the loess-like deposits on some terraces or slopes from Subcarpathian Hills, Transilvanian Plateau and some intramontanian depressions (Table 1).

In Romania loess thickness varies from 6 meters in Constanta to a maximum of 60 meters in Tulcea (Table 2)

Table 1. The origin of the loess deposits in Romania according to "THE LOESS FROM ROMANIA IN THE ROMANIAN SPECIALIST VISION" (after Ghergina, Grecu, Cotet).

Area	Geological origin
Eastern Romanian Plain	Aeolian loess proceeded from alluvial meadows.
Central part of the Romanian Plain	Loess and loess-like deposits with different texture and alluvial and proluvial genesis.
Oltenia Plain	Loess-like deposits with loamy texture and complex genesis: deluvial, alluvial and aeolian.
The Getic Plateau	Loess-like deposits with different texture and genesis: deluvial-aeolian on interfluves, deluvial-alluvial on terraces and aeolian on upper terraces.
Dobrogea	Typical loess with paleosoils on interfluves, aeolian origin on southern interfluves, deluvial aeolian on slopes in north and center and eluvial-deluvial on terraces.
Moldavia	Aeolian loess in south, loess-like deposits in Jijia Plain; alluvial loess-like deposits on terraces, loess-like deposits proceeded from marls on interfluves.
The West Plain	At south of the Mures river, aeolian and sandy loess at north of the Mures river.
Transilvanian Plateau, Brasov Depression and Curbura Subcarpatian Hills	Loess-like deposits with different texture and complex genesis: alluvial, proluvial-coluvial and aeolian.

Table 2. Thickness of the loess deposits in Romania (NP 125-2009).

Area	Deposit thickness
Right bank of the Danube (from Ostrov downstream)	30 m
Cernavoda, Tulcea - the left bank of the Borcea arm	40-60 m
Tecuci - Nicoreşti	50 m
Ialomiţei valley – Marculeşti, Ţăndărei Turnu Măgurele	30 m
Brăila, Galaţi	10-35 m
Feteşti	25-35 m
Constanţa	6-10 m
Giurgiu	6-10 m
Covurlui plain	7 m
Tecuci	7-8 m

CONCLUSIONS

Loess and loess-like sediments cover 10% of Earth's land surfaces, in Europe, loess and loess-like sediments cover almost 1/5 of its total land surface.

Many loess deposits from the eastern and central Europe has been re-deposited by the Danube River and its tributaries.

In Romania the area occupied by the loess and loess-like deposits is about 40.000 km² and is spread on the interfluves and the top of the terraces from pericarpathian regions.

Variations in the source of the loess can be constrained geochemically through the analyses of major and trace elements within the bulk composition.

The researches on loess and loess-like deposits from Romania begun at the end of the XIXth century with paper "Relation sommaire sur la structure geologique dans les jud. de Tutova, Fălciu, Covurlui, Ialomiţa et Ilfov", by Gr. Stefanescu. The complex studies achieved in time, at macro- and micro-regional level covered many themes and leaded to knowledge of the loess and loess-like deposit characteristics and extent.

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ENHANCING THE STRUCTURAL BEHAVIOUR OF REINFORCED CONCRETE BUILDINGS UNDER SEISMIC ACTIONS

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Abstract

Romanian earthquakes since 1940 and 1977 have produced severe damages to a significant number of RC framed buildings whose plans were characterized predominantly by irregularities like flexible diaphragms, structural discontinuities or L or H shapes, among others. These conceptual characteristics contributed in a decisive way to the damage or collapse of buildings designed and built according to old seismic codes.On the other hand, European and internationalexperience of the past strong earthquakes during last decades shows that, in many urban areas besides many old building, there is a number of modern RC buildings that do not meet the requirements of additionally improved Codes for seismic resistant design. The paper presentssome types of structural interventions on buildings and solutions for determine the dynamic building response. On basis of dynamic response recorded for buildings, a methodology for analyzing the structural behavior of this typology of buildings by adequatesoftware for 3D seismic analyzing is presented. For this purpose non-destructive and geodynamic methods were used. The non-destructive methods are based on auscultation, ultrasound and percussion with Schmidt hammer, and the geodynamic methods are based on the GEODAS equipment with Microwave software.The results proved that the mass and stiffness is not always beneficial and also emphasizes the role of geometry on dynamic response of building.

Key words:earthquake, structure, seismic response, building instrumentation.

INTRODUCTION

The paper presents a detailed study of buildings with irregular forms in plan and elevation.
To improve the seismic response it were considered different tipes of structural interventions. Certainly the paper presents a comparative study between the buildings with different forms in plan and elevation and GF+8Storeys heigh.
To make the optimum choice of consolidation were used the methods presented in the seismic design code P100-3:2008.The evaluation of existent buildings,the annex with refference at reinforced concrete and brickwork buildings (Dragomir, 2013).

MATERIALS AND METHODS

As methods of structural calculation the Autodesk Robot Structural Analysis Professional software based on the method of equivalent static seismic forces andthe method of modal analysis with response spectra were used (Gruia et al., 2013).
The method of equivalent static seismic forcescan be applied to buildings for which the characteristics can be calculated through the consideration of two plane models on orthogonal directions and for which the total seismic response is not significantly altered by the higher oscillation Eigen modes. In this case, its fundamental mode of translationhas a predominant influence in the total seismic response.The main shear force corresponds to the proper fundamental mode, for each of the

primary horizontal directions considered in the building's calculations, isdetermined as followed:

$$F_b = \gamma_I S(T_1) m \lambda \qquad (1)$$

where:

$S(T_1)$ - is the design response spectrum ordinate correspondent to the fundamental period;

T_1 - is the primary fundamental period of oscillation for the building in the plan that contains the considered horizontal line;

m – is the building's total mass;

γ_I - is the importance (exposure) factor of building;

λ – is the correction factor that considers the proper fundamental mode through the effective modal mass associated to it, whose values are $\lambda = 0,85$ if$T_1 \leq T_C$ and the building has more than 2 floors and $\lambda = 1,0$ in the other cases.

The primary fundamental period T_1 is determined using a dynamic structural calculation. For the structures considered in the calculation the following expression regarding the main shear force:

$$F_b = \gamma_I S(T_1) m \lambda$$
$$= 1,20 x 0,24 x \frac{2,75}{4,725} x 0,85 x m$$
$$=> F_b = 0,14 m$$

In the method of modal analysis, seismic action is evaluated based on response spectra corresponding to unidirectional translational movement of ground described by accelerograms. Horizontal seismic actions described by two horizontal components measured on the same design response spectrum. The vertical component of seismic action is characterized by vertical response spectrum. This analysis method applies to buildings that do not meet the specified conditions for use of the simplified equivalent static lateral forces. For buildings that meet the principles of regularity in plan and vertical uniformity principle, the calculation can be done using two plane structural models corresponding to the main horizontal orthogonal directions. Buildings that do not meet the above principles will be calculated with spatial models. When using a spatial model, seismic action will apply to the relevant horizontal and orthogonal principal directions. For buildings with structural elements located in two perpendicular directions can be considered as relevant. Usually, the main directions corresponding with the bases hear force associated with the fundamental mode of translation oscillation and the normal force on this direction. The structures with linear behaviour are characterized by their own modes of oscillation (natural period, proper oscillation shapes, effective modal masses, and effective modal mass of participation factors). They are determined by dynamic calculation methods using dynamic inertial and deformation characteristics of structural systems resistant to seismic action. In calculating Eigen modes will consider a contribution to the total seismic response.

A conceptual design of structures located in seismic areas that ensures adequate seismic behaviour is very important.

Simplicity of the structure assumes a continuous and strong enough structural system that can ensure a clear path, uninterrupted for the seismic forces directly to the foundation soil. An example of discontinuity of seismic actions is a big hole in the ceiling or a lack of reinforcement. Seismic design should aim producing a structure as regular and as uniform distributed in plan so that inertial forces are transmitted directly on the shortest way to the foundations.

RESULTS AND DISCUSSIONS

In the first part of the study it was choosed as example five different shapes of structures in plan and elevation (Dragomir, 2011):
- The first one and the second have rectangular form and the dimensions in plan are different from each other (the second structure is 25% longer than the first);
- The third one has the shape of "L" with one of sides longer than the other with 25%;
- The fourth structure has the shape of "L" with equal sides in plan.
- The fifth structure has the shape of "L" with equal sides in plan but unequal in elvation (the side coresponding the x axe is in steps form starting from the superior part of the building).
It was considered a span of 5 meters and a constant storey heigh of 3 meters.

Concrete used is C16/20, sections of columns are 45x45 cm; the beams sectionsare 30x50 cm and the reinforcement has been made according to the current regulation. It should be mentioned that in each case the structure were embeded at the base.
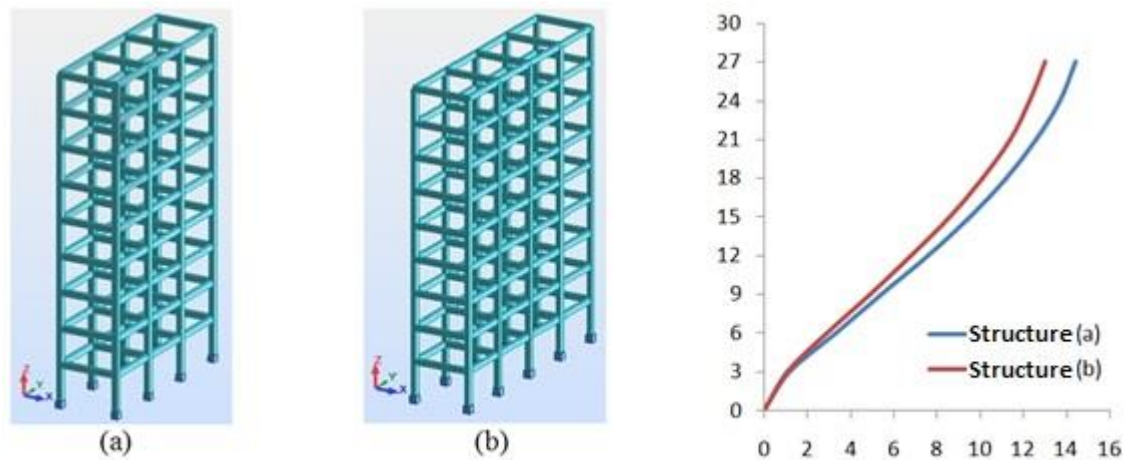
Figure 1. 3D representation of the structures and comparative chart of displacements on x direction

We observe that between the first types of structures, (Figure1.a and 1.b) the displacement values are relatively small (about 8%).
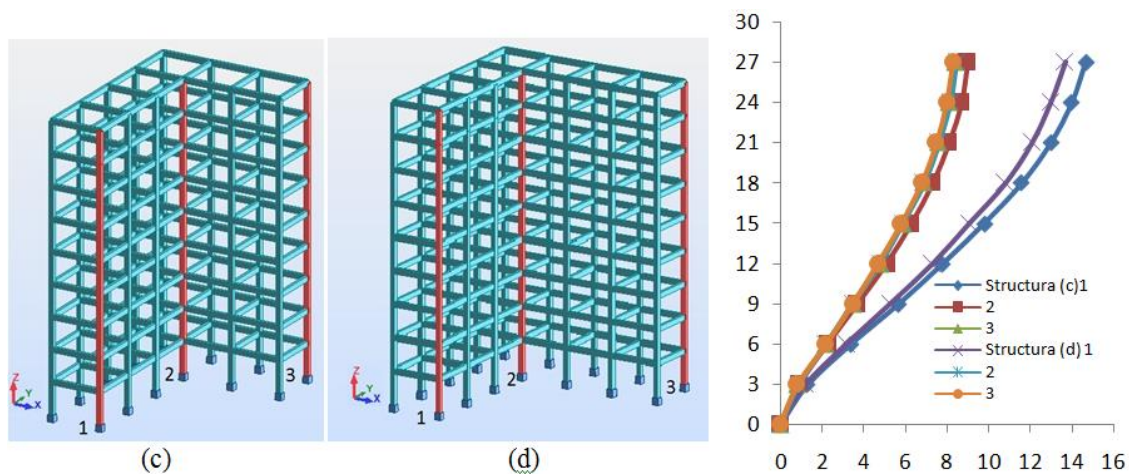
Figure 2. 3D representation of the structures and comparative chart of displacements on x direction

Incase of irregular shape dbuildings the displacements will be consider on the three edgesof the buildingas it can be observed emphasized in red colour in the Figure 2 and 3.It clearly observed that the displacements from the edge 1 are considerably higher than the values of edge 2 and 3.

The displacement values on first edge of the building are more 50% higher than the other.The overall difference between those buildings is very small, similar with the first case.
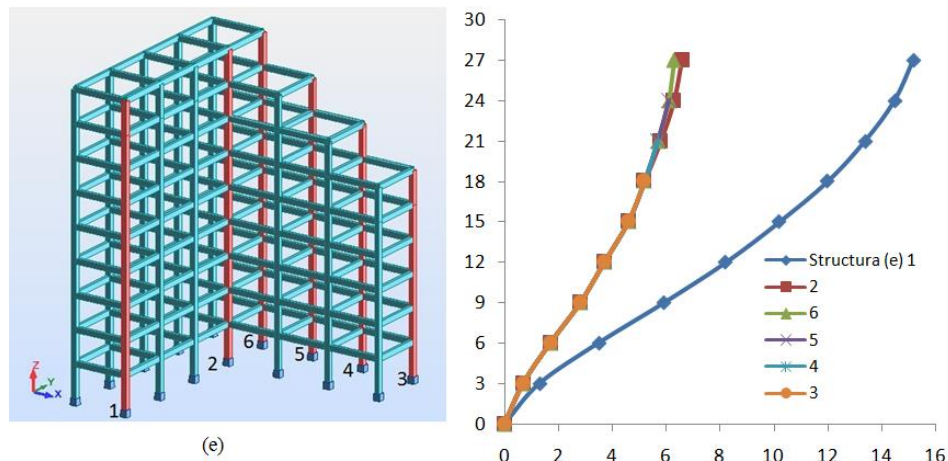
Figure 3. 3D representation of the structures and comparative chart of displacements on x direction

For the building with irregular shape in plan and elevation, as you can see in Figure 3, the displacement of edge 1 is more than 50% comparating with the other edges.In conclusion the elevation irregularity produces this difference in seismic behavior.
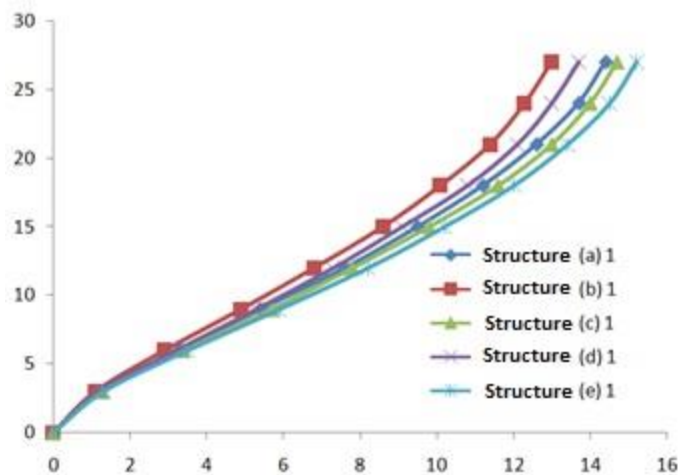
Figure 4.The comparative representation of displacements for all five structures on x direction

In Figure 4 are represented vertical edge displacements versus the height regime of buildings. It can be observed that the difference between the extremes is not very high.
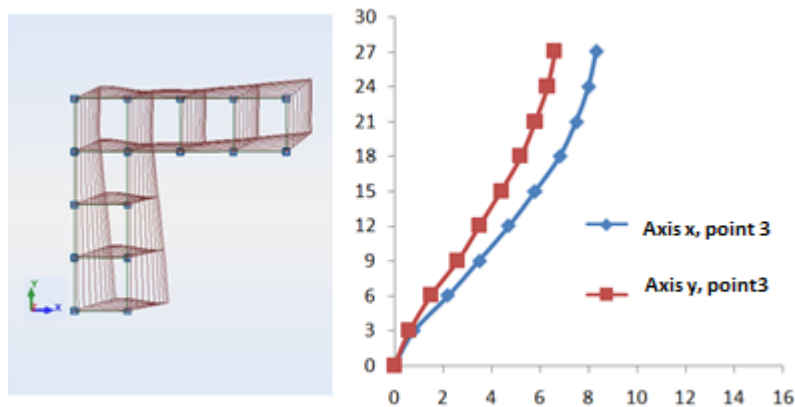
Figure 5.The deformed at the superior side and the comparative displacement on x and y direction

It is worth mentioning that al though the earthquakeis induced exclusively on the x axis, on buildings with L-shapes, appear large displacements on y directionas shown in the Figure 5.

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In Figure 6 it can be seen specific movements of the buildings on the x-axis under seismic action induced in the x direction,and in the Figure 7 is presented the graph that contains periods of oscillation for each structure depending on the shape. These periods correspond to the first three fundamental modes of oscillation.
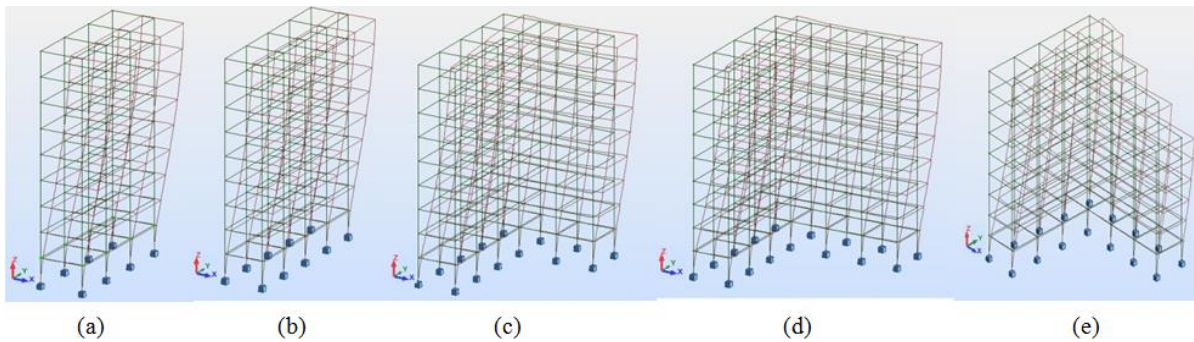
Figure 6.Representation of the five 3D deformation shapes and the structure displacements

In Figure 7 it can be observed that for buildings with irregular shape the oscillation period varies in each of the three modes.
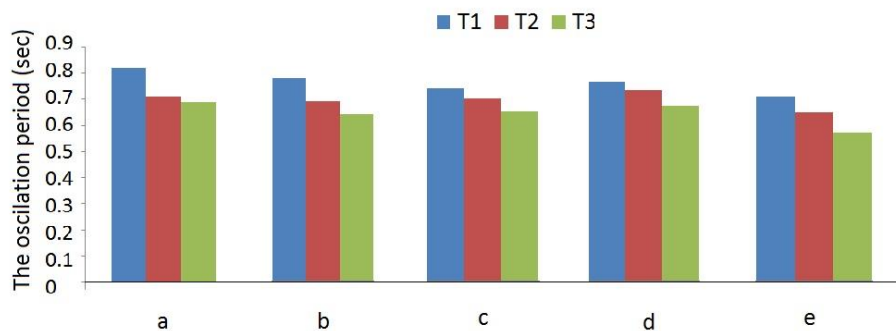
Figure 7.The values of the oscilation periods for the structures

Strengthening the structures applying the base isolation method

In the second part of the studyit was chosen a rectangular structure in plan with GF+8 Storeys, which was under a strengthening work. This intervention was determined radically changes on the behavior of the building during an earthquake. In literature, the method is known as *the base isolation method*.
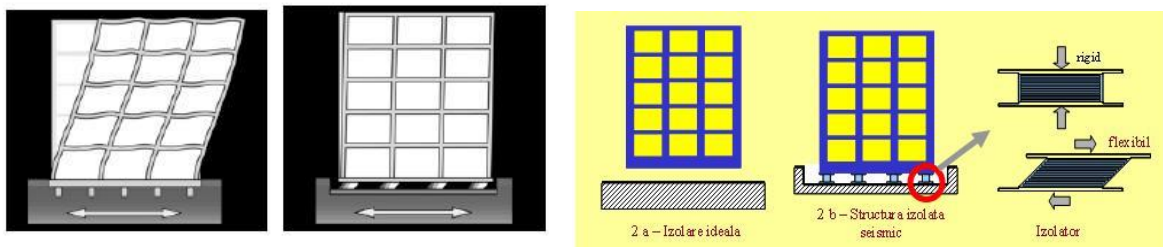
Figure 8.The concept of base isolation

It is probably the best decision when choosing a precautionary measure to avoid a disaster produced by earthquakes. The method basically involves separating the superstructure of the building infrastructure, or better said, the method replaces "rigid fitting", which offers no degree of freedom, with an "elastic fitting" which allows the building, at a certain extent, to move in absolute any direction.This movement that occurs, in this case at base of the building is controlled by hydraulic systems for the amortization of translational motion.The

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structures with the isolated base are generally equipped with additional devices to increase the amortization in order to reduce large displacements at interface level of isolation.These devices can operate in passive mode, in which case the amortization provided is constant throughout the operation, or under semi-active or active, in which case the variable amortization is adjustable upon request.

In the seismic isolation, the main purpose is to reduce the substantial energy and seismic forces transmitted to the structure. This is achieved by settlement of the structure on an insulating layer with very low lateral rigidity so that during an earthquake, when the ground strongly vibrates, in structure is induced only moderate movements. Due to the low lateral stiffness of the insulation layer,the structure has a fundamental period greater than the fundamental period of the same structure but with fixed base.

Depending on the type of device used, the level of damping can vary significantly (from a few percent of critical damping at levels of 40% or more).It is obvious that a low level of amortization does not benefit the structural response, but at the same time an excessively high level of amortization can also be a deficiencies generator by focusing the substantial local forces and by changing the overall dynamic response to negative.Also, in the case of a semi-active amortization the power in these devices is limited and reduced to the force generated in a passive device.The level of a force in the semi-active mode similar to that in the passive mode, the two devices have similar behavior, and for a very low power in the semi-active mode against the passive mode, the effectiveness of amortization device itself is no longer interesting.
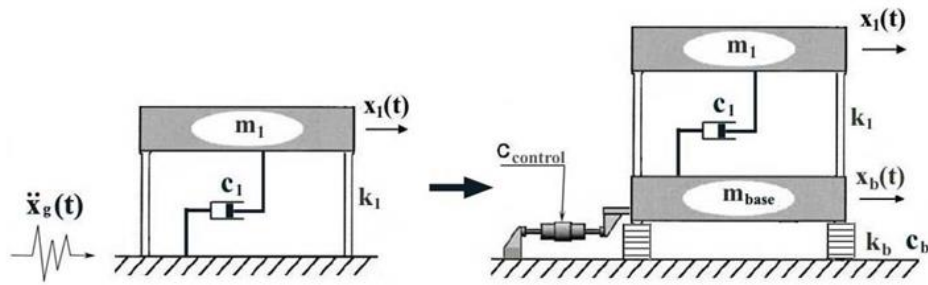
Figure 9.The model which parametric study is conducted to identify optimal amortization characteristics.

The model above is derived from a model with fixed base (left). The mass and rigidity are chosen so that it leads to their own vibration period of 0.93 seconds. Natural amortization level of the system is 5%. This model is equipped with an interface of base isolation composed of base isolators without additional amortization with dynamic features chosen so that the period of the isolated system to be 3.39 seconds (right). The rigidity parameter thus remains constant during the analysis.

Energy balance system with 1 DDF

It will analyze, from the energy point of view, balance equations for a conventional system with one DDF, the usual mass and rigidity characteristics, respectively for one isolated and provided with additional passive amortization, modeled as a 2-DDF system and will present proportion which the different forms of energy dissipation have against the total energy.

For a dynamic system starting from relative response values, the energy balance can be made according to the relation 2.

$$E_{cr}+E_d+E_{abs}=E_i \ (2)$$

where:E_{kr}- kinetic energy is "relative", E_d - the energy dissipated by viscous amortization, E_{abs} - energy absorbed by the system and E_{ir} - "relative" induced energy.

The absorbed energy system consists of energy consumed for elastic deformation (recoverable)

- E_s and the energy dissipated by plastic deformation or dissipated due to nonlinear elastic behavior of the material - E_{hyst}

$$E_{abs}=E_s+E_{hyst} \qquad (3)$$

In systems with linear elastic behavior practically all the induced energy is dissipated by viscous amortization because $E_{hyst}=0$.

For isolated base systems or equipped with additional energy disipators is preferred that the induced energy is dissipated by the special dissipation devices and not any particular set of plastic deformation. In the second case, the control mode of how induced energy is consumed by plastic deformation is hard to do.The first example relates to the 1-DDF system with linearly elastic behavior. The system is so dimensioned as to have a period of 0.5 seconds, and an amortization level of 5% of critical amortization. The distribution of the energy absorbed by the system and thepostelastic deformation E_{hyst}, as a proportion of total energy induced E_{ir} leads to the graphs which are shown in Figure 10.
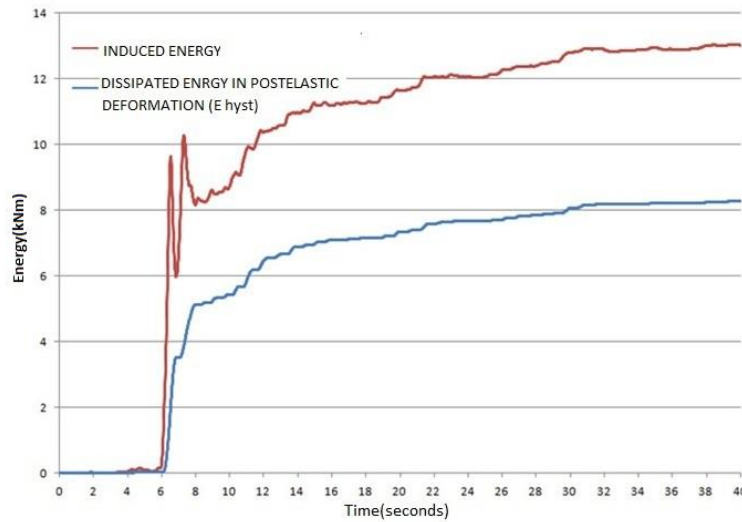
Figure 10. Distribution of energy absorbed by the system and reflected by postelastic deformation (Pavel, 2012)
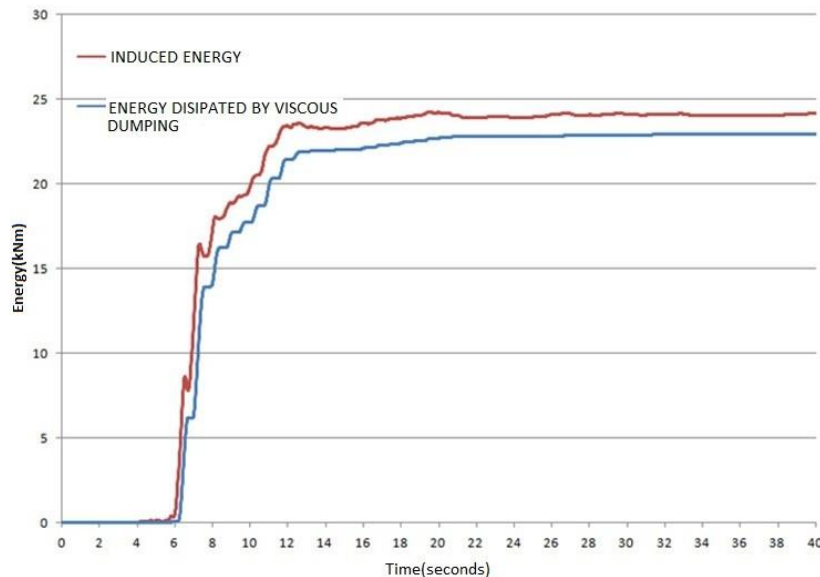
Figure 11.Distribution ofenergy dissipatedbyamortization(Pavel, 2012)

In comparison, the same system with one DDF will equip an isolation interface with rigidity and mass chosen so that the isolated system will provide a period of 3.0 seconds and an

amortization coefficient equivalent to a fraction of critical amortization of 25%. Taking into account the mass and rigidity of the isolation system and the new level of amortization,the changes of the energy distribution by the system is shown in Figure 11.

By benchmarking graphs above it is noted that in the case of the isolated system and additional amortized, most of the induced energy is dissipated at the level isolation interface. In these conditions, the system will have an elastic behavior, whereas the proportion of energy dissipated by viscous equivalent amortization for the isolated system is significantly higher than that dissipated by hysteretic deformations in the case of the conventional system.

Issues related to design spectra

In Figure 12 is shown the elastic spectra of accelerations (AS) and displacements (DS). It can be clearly observed the dynamic effect obtained by seismic base isolation.
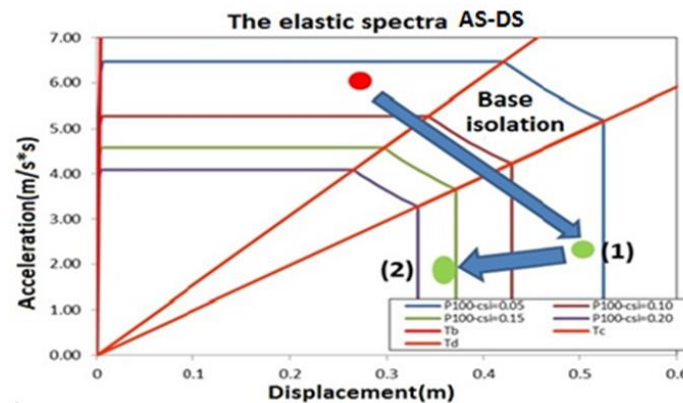
Figure 12.The AS-DS spectra (Oprisoreanu, 2012)

By decoupling the infrastructure of the superstructure and introduction the isolation devices it is obtain an "extention" of the fundamental period of vibration. This extension results at the acceleration requirement in the superstructure but increasing movement requirement (step 1). By introducing a degree of damping in the isolation system it`s reduces the requirement of the superstructure displacements (step 2). Note that as mentioned above this displacement requirement is concentrated almost entirely in the isolation system.

Acceleration spectrum analysis reveals the following:

 a) Ground seismic generate maximum spectral accelerations in their periods of 1.20 .. 1.50 sec. This interval is associated with fundamental periods of vibration of buildings with medium to high altitude regime (8-15 floors). In conclusion, the maximum dynamic amplifications of acceleration are registered at these buildings and not at those with low heights.
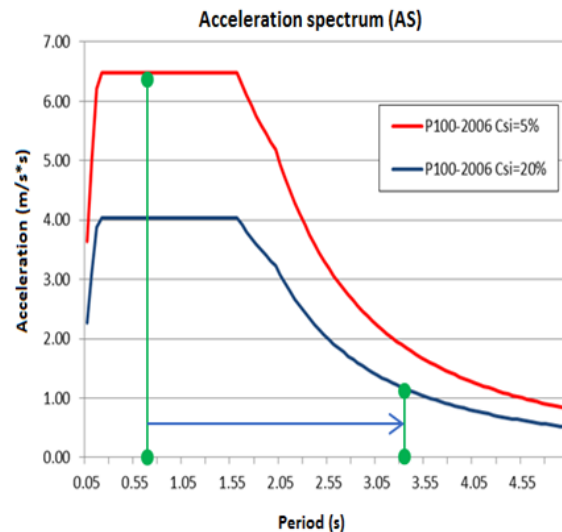
Figure 13. The acceleration spectrum (Oprisoreanu, 2012)

b) The philosophy of structural response control methods through the type base isolation technology involves decoupling the structure of the ground so that she has an answer like a rigid solid (no lateral deformations) with a period close to that of isolators. A typical value for the period isolated system recommended in the literature in this field is about 2.5 sec. The

particular conditions of seismicity of our country, this value is unsatisfactory and should be increased to 3.5 to 4.0 seconds to remove the effects of relative motion of the structure, given that, from numerical studies, the value of 2, 5 seconds still recorded dynamic amplifications relative movement of isolated structure;

c) By reducing the acceleration spectra it can be obtained an elastic response for a force design level comparable to that used for conventional structures in which are used behavioral factors significantly above unit. This reduction is not effective in periods below 3.5…4 seconds

Displacement spectrum analysis reveals the following:

a) The elastic displacement spectra family for different amortization levels emphassis the high requirement of specific movements of Vrancea earthquakes and significant importance to high amortization level. An amortization level of the order of 20-40% results in a reduction of the requirements for up to 2-3 times the requirements of the elastic displacement;

b) travel requirements particularly high lead, among other things, to the need to ensure a point of the order of at least 40..50 cm between the isolated structure and the environment. They can also generate problems relating to the return of the building to its original position after the termination of seismic action, as well as the design of izolators.
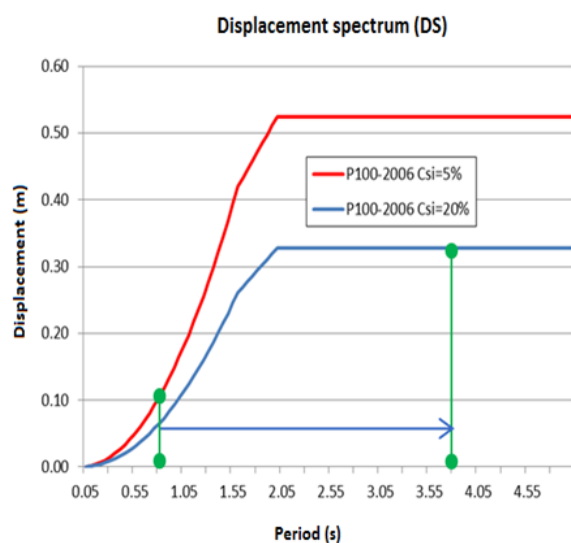
Figure 14. The displacement spectrum (Oprisoreanu, 2012)

CONCLUSIONS

Analyzing the results it can be say the construction irregularities cannot be avoided and they appear from functional reasons in plan, and technological for height. Theoretical problems of irregularities are treated with the study of relative relation between the center of rotation CR and center of gravity CG.At constructions of irregular weight-geometry relation, has an important role and are controlled using the principles of conceptual design code P100-1/2013 or Eurocode 8, Part 1. In the case of base isolation, displacement occurs only at the bottom of the building. Inother words, the building no longer behaves as an elastic body but as rigid because a large part of the energy transmitted to the top of the building is taken amortization systems that provide functionality integrated along with elastic elements acting as bearing for the building. As a result, the effectiveness of seismic isolation devices is lower in the particular case of our country. Also, the use of base isolation devices must necessarily be accompanied by the use of passive amortization devices, semi-active or active to reduce the large movements supported by insulators.

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STUDIES AND RESEARCHES FOR IMPROVEMENT AND PROTECTION, BY FORESTRY WAY, OF THE EMBANKMENTS AFFERENT TO NATIONAL ROAD 17 – TIHUŢA GORGE

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Abstract

This study has as its purpose finding and presentation of the most effective ways of improving and protection of the embankments afferent to national road 17 – Tihuţa Gorge, perimeter situated in Bistriţa-Năsăud and Suceava counties. The main causes leading to the destruction of land are represented on the one hand by natural setting's characteristics of the perimeter: uneven relief with high pitch, heavy textured soil and damp climate, and on the other hand by misuse of land and deforestation. The prerequisite for improving these downgraded lands are restoration of the vegetation and resonable use of it, prerequisite on which the choice of the improving actions and works is based on. The improving actions are: usage restrictions (grazing ban), exploitation rules, perimeter security, the installation of panels, and the improvement works are: phytoimproving measures (afforestation), soil preparation and improvement works (fertilization and amendation works), soil arrange works (draining). Afforestation is the main path to follow in downgraded land contention. The actual surface intended for afforestation from this perimeter Tihuţa-Colibiţa is 80% of downgraded lands from this perimeter.

Key words: embankment, relief, afforestation, soil, downgraded lands.

INTRODUCTION

As the deforestations and misuse of land were the causes that led to their destruction, so the re-vegetation and rational use are the basic conditions for the restoration of the degraded lands. In our country there are many regions where the land is in the course of sliding or prone to sliding. On this land the erosion has such an intense activity that, in a relatively short time, their evolution generates torrential formations. (Chiriţă, C., 1977)

The gravitational mass movement is a degradation process which affects the stability of slopes and it is produced by the direct action of the terrestrial gravity, supplemented by the action of the infiltration water. The main link is represented by the phyto-improvement afforestation works with the purpose of protecting, aestheticization and valorification of the degraded land. In most cases, the landslides are caused by top to bottom dipping through water excess of some soil layers characterised by certain composition and alignment.

The present study aims to identify and to implement the most effective methods of improvement and protection of the embankments afferent to national road 17. From the geographical point of view, the analyzed perimeter is located in the Tihuta Pass, its southern part, within Bistrita-Nasaud and Suceava counties.

The perimeter taken into study is part of the slope's morphostructural unit. Regarding the rainfall erosion, the petrographic substrate intervenes both directly and indirectly. The origin of the substrate is represented by loess marl, sandstone and clay-like soil, which indicates a particularly high potential for erosion. On the other hand, the geological substrate is the main natural circumstance that determines the land predisposition to move. Since the substrate is relatively impermeable, having a clay-marl composition, it is very susceptible to the generation of landslides as the water infiltrates into the soil, stagnates over these substrates causing soil dipping which slides under its own weight.

Among the geo-morphological factors, the slope and the inclination have the greatest influence on triggering erosion. The inclined lands, in their entirety, are susceptible to degradation by erosion. One can say that all lands within the improvement perimeter can be considered as being eroded because of slopes. Regarding the rainfall erosion, the precipitous morphological slopes that exceed 60% increase rainwater runoff and on the unprotected portions of vegetation it enhances the erosion process, by increasing its magnitude.

Table 1 Synthesis of the geo-morphological data

Length of perimeter (km)	81
Mean altitude (m)	850
Mean slope (°)	30
Minimum slope (°)	10
Maximum slope (°)	40
General exposition	N-E

Another factor that intervenes in carrying out this process is the exposition of land. Thus, the predominant and sunny general exposition of lands within the perimeter causes a greater predisposition to rainfall erosion because they are subject to more pronounced thermal variations, are dry, support a rare vegetation and they are more intensively exploited from the pastoral point of view. Although the rainwater leakage is reduced, still the depletion of soil is more intense than the shaded expositions.

The improvement perimeter of Tihuţa-Colibiţa is located in the sector of moderate continental climate, corresponding to tablelands. The thermic regime is characterised by: mean annual temperatures of 9,8°C, thermic amplitude of 25,7°C, bioactive period of 279 days and a vegetation period of 186 days. The seasonal variation of mean atmospheric precipitations registers a peak during the summer (273,9 mm), and during winter a minimum value (87,5 mm). During the vegetation period a quantity of 406,8 mm of precipitation is registered. Regarding the wind regime one mentions that, although the area is characterized by a wind regime with moderate winds, still there have been reported higher intensity winds and, exceptionally, even storms.

Following the climate synthesis it results: the climatic conditions in the improvement perimeter of Tihuţa-Colibiţa are favourable to the occurrence of degradation phenomena, as those present in the studied area, namely rainfall erosion and landslides.

This present perimeter is located in the hydrographical basin of Bistriţa river, it has no internal hydrographic network, the hydrographic regime being unbalanced lead to the appearance of runoff gullies formed in dales, result of waviness of slopes and their collapse.

In the Tihuţa-Colibiţa perimeter the following types of soil are met:

Class: undeveloped truncated or arent soils

Soil type: Rendzina

From the vegetation point of view, the perimeter is a part of the region of common beech forests and mixtures of common beech and resinous (*Fagus sylvatica* in combination with *Carex* sp. and *Oxalis,* or *Fagus sylvatica* and *Picea abies* with *Oxalis acetosella* with mull flora).

Instead of the natural vegetation consisting of common beech and spruce forests, due to the deforestation and the overgrazing abusive practice, led to its disappearance and the installation of one that does not provide effective protection of the soil and, sometimes, it does not even exist.

Concerning the rainfall erosion, the vegetation should be a real barrage against soil degradation. The vegetation is the factor that ensures the stability of land, preventing or limiting the mass and rock movement on the slope.

The main objective is to protect the embankments around the present perimeter and the existing stands in this area.

The main concern of the present project is the ratio between the vegetation, as a factor of resistance, and soil erosion, as a process of destruction.

MATERIALS AND METHODS

The land restoration works requires special attention and advertising from the beginning: studies, research, measurements, projects and a good organization.

It is necessary to study in detail all physical, economic and social causes that led to the degradation of these lands. Also, it is necessary to make an inventory of all damaged areas. The lands that compose an improvement perimeter are grouped on hydrographic basins, natural units of which they are part. The inventory is made by simple measurements with different expeditious means. Based on these studies, at first, an activity plan and means to be used are drawn-up. (Florescu, I.I., Nicolescu, V.N., 1996)

The role of the project is to establish in detail the type of works to be performed, where and when to carry them out. Based on project's details, one makes the registration of the works in the annual working-plan and plans in detail the activities to be carried out. Schematically, the ameliorative complex for combating the degradation process and improvement-valorification of degraded lands, includes ameliorative measures and improvement works. The ameliorative measures have an organisational character and concern, on one hand, the degraded lands included in the improvement perimeter, and, on the other hand, the lands surrounding the respective perimeters, which by their position and condition influence the degradation..

In turn, the improvement works have a technical character and relate exclusively to the improvement perimeter. These include technical interventions and intend to improve, protect and value the lands included in the respective perimeters.

In relation to the above mentioned, in the present case, the ameliorative complex of combating the degradation and the improvement–valorification of lands includes the following:

Ameliorative measures: restriction on use (grazing interdiction), operating rules, security of the perimeter, installation of panels, propaganda work carried among population.

All these measures are designed to prevent, expand, intensify or reactivate the degradation processes.

The improvement works are technical interventions carried out exclusively in the improvement perimeter in order to rebuild, protect and valorificate the land.

Improvement works: phytoimproving measures (afforestation), soil preparation and improvement works (fertilization works, amendation works and preparation of soil in patches), soil management plan works (simple and supported terraces, brush head pug, levelling-modelling, drain and drainage).

The core of the ameliorative complex adapted in the present case is represented by the phytoimprovement works, especially by the afforestation works, able to solve most of the problems which arise and find a solution.

All other measures and works, although very important, are still secondary, being designed to support, complete or supplement or the afforestation works. The forest is the only one capable to improve, protect, stable the soil on long-term.

In relation to the previous presented hierarchy, it is however to be noted that afforestation works cannot fulfil their role of fundamental link from the beginning. Thus, after a first stage, with a length of about 5 years, where the main role is fulfilled especially by the management plan works, in the next stage, this role is taken and performed exclusively by the forest.

Regarding the management plan works of the land, which have an important role, sometimes crucial, in the first stage of the improvement-valorification action, they include a variety of works of a special nature, aimed at proper preparing of land for afforestation.

These works depend mainly on both the nature and intensity of degradation and the state of affected lands and they comprise the following categories (for the Tihuţa-Colibiţa perimeter): consolidation works for slopes, ravines, embankments and runoff beds; land slide stabilization works.

RESULTS AND DISCUSSIONS

In designing the ameliorative complex, the purpose is to determine the character and the extension of the interventions so as to achieve an ensemble more efficiently, with minimal cost and location and judicious staggering of the ameliorative complex. The volume and location of the proposed works will be expressed in the following table.

As it can be seen, according to the local particularities and the extension of the degradation processes, each surface requires certain works, each work affecting a smaller or higher percentage of this area.

Table 2 Nature and location of the proposed works

Nr. crt.	Name of work	Location of works	Observations
1	Afforestation works	DN 17 BN-SV	Over all, less than 20% of the gully corridor
2	Fertilization using topsoil	DN 17 BN-SV	Ravines, embankments
3	Preparation of soil in patches	DN 17 BN-SV	Embankments on slopes up to 30%
4	Terrace supported by fences	DN 17 BN-SV	On lands with slopes of 30-70% and 2/3 of the gully corridor
5	Levelling - modelling	DN 17 BN-SV	On half of the sliding land surface
6	Drain and drainage works	DN 17 BN-SV	On the land with excess of water, and about half of the sliding land
7	Enclosure works	DN 17 BN-SV	Where appropriate

The effective area for afforestation from the improvement perimeter represents 80% of the degraded lands within the perimeter. The afforestation is the fundamental way to combat land degradation. Indeed the role of the forest vegetation is critical because it regulates the rainfall leaking, stabilizes, restores, improves, protects and valorificates the lands, being an important, complete and decisive means in combating land degradation. Thus, following the appearance of the forest, the kinetic energy will be reduced by the canopy screen, which will retain some of the precipitations. Also, it will restructure the soil, will actively participate in the genesis of soils (paedogenesis) and because of the litter layers there will be a better infiltration and superficial retention, thus the quantum of rainoff waters will be notably reduced resulting in stopping and restoring the action.

Within the improvement perimeter, one uses massive forest crops, which are the main form of lands' afforestation.

Following the installation of forest crops, they will have a main role of protection and then a production and aesthetic role. The protection role of crops is to protect soils against rainfall erosion and land covered by agricultural crops. In terms of production, by installing the forest crops, it is expected to obtain: firewood, poles, stakes for vineyard, resin, mushrooms and berries. The harvest of the latter should be done with extreme caution, with teams made of few people, with caution not to cause any damage to the perimeter by puddling the land.

The particularities of lands for afforestation determine the silvotechnics of eroded land to be a special technique, which requires a mandatory additional attention when choosing forest species to be used, establishing the formulas and mixing schemes, use of best quality of seedlings, adoption of special ways of working, as well as technical perfection in all aspects.

The key to a successful afforestation activity within the lands affected by degradation is the carefully selection of forest species.

The extreme conditions in which the works are performed cause the elimination of sensitive species or the ones too demanding and does not allow but the installation of cultures composed of resistant and modest forest species, with a high ecological amplitude.

In principle, when choosing the forest species, attention is paid to the stationary conditions and the ecological requirements of forest species, on one hand, and, on the other hand, to the leading role that the forest culture to be installed has to fulfil, namely the protection and support of soil.

Comparing the conditions set by mapping with the ecological requirements of the species given by their ecological records, one can determine for each site type the list of species that can be successfully used in afforestation. Obviously, out of this possible list, one will choose those species that exceptionally satisfy the leading role they have to fulfil, namely fixation and improvement of soil.

Having in view the ecological requirements of the species, and given that the area is located in the common beech and spruce storey, the following species have been chosen for the afforestation of the improvement perimeter: common spruce, European black pine and

acacia and the shrub species: seadbucktorn and bastard indigo.

The afforestation formulas for the site types were determined accordingly to the established formulas principle: 75% acacia, 25% seadbucktorn; 60% European black pine, 40% bastard indigo; 60% common spruce, 40% European black pine; 100% seadbucktorn; 60% common spruce, 40% acacia.

For the lands characterised by moderate erosion and gentile slopes the following formula was adopted: 75% acacia and 25% seadbucktorn, because the vegetation can be reinstalled only here, for the rest of the land a failure being possible due to the unfavourable soil conditions. For the strongly eroded lands with precipitous slopes, one installed the seadbucktorn and the bastard indigo for they rise quickly and it is expected to successfully protect the soil until they reach the close crop.

For the ravines and the natural embankments it is recommended the use of seadbucktorn alone, this shrub being able to stop the degradation of these areas.

For the sub-types represented by very strong and excessively eroded lands, the European black pine and the common spruce is recommended, or the seadbucktorn, these species, especially the seadbucktorn, being able to stop the sliding phenomena, being suitable even for soils with a medium to light texture.

All species, both trees and shrubs, were chosen so as to be compatible with soils with hard texture, specific to common beech and spruce storey.

The afforestation formulas are transposed on the land using some scheme which show the management of species, and for the achievement of sustainable mixtures, they are classified on site types and site sub-types, as it follows: bunches of 100 sqm, mixture of individual trees (due to extreme conditions in terms of degradation) or pure culture. When choosing the species, the following objectives will be taken into consideration: stopping the degradation processes and the improvement of soils; the economic-social interests.

Between these two main objectives, the most important is the first one, namely stopping the degradation processes and the improvement of soils. In order to achieve these objectives, it have been chosen species able to resist and to develop optimum form the ecologically point of view within the existing sites, and out of these species the ones that prove the best abilities to develop, respectively the best wood production.

European black pine – was less used for the improvement of the eroded and sliding lands, but as compared with the Scots pine, it is preferred as it registers a favourable development on soils with light to medium texture, on loess substrates. It grows well in mixtures with hardwood species.

Seadbucktorn - one of the most used shrubs in the afforestation of the degraded lands. This is due to its resistance to the toughest soil conditions. It has a very rich root system. It assimilates nitrogen direct from the atmosphere via its nodosities located on the roots.

It has been widely used in the afforestation of the most difficult categories of eroded and sliding; after 3-5 years of a slower growth, the bushes become stuffed and regenerates from root suckers; after 10-15 years, the land becomes completely covered; it registered good results on sliding lands with the hardest conditions, respectively sliding lands with mass movement with strong and very strong fragmented with marl and marl-clay substrates; it closes the massif after 4-7, when it starts the strong regeneration from root suckers, forming very dense shrubs that strengthens and improves well the soil. It supports very well the potential damages caused by the reactivation of landslides after planting.

Bastard indigo - it is a species that can withstand drought well, behaving very well on lands with warmly summers, affected by drought, on poor sandy or rich soils affected by erosion, fit for the afforestation of sliding lands; sprouts, send out suckers and layers; enriches the soil with nitrogen, making symbiosis with nitrifying bacteria species; it is also appreciated and used as ornamental crops.

For the full success of the forest crops, which install on the land affected by degradation, it is not sufficient only a careful selection of species and their grouping in formulas and mixing schemes, but it is necessary to adopt a proper working technique. Mainly, the technique to be applied so as to install the forest crops must attenuate the excessive conditions and increase the deficient items. Thus, in order to increase

the chances for a successful afforestation on lands with relatively poor soils, the afforestation technique has to remedy these shortcomings, and for this purpose natural fertilizer, mainly organic fertilizer and earth for filling up will be used.

Due to the rough conditions in which the work is carried out, the main working method is planting, made with ordinary best quality seedlings with roots without covering. The afforestation processes are also numerous, depending on the working conditions. Thus, the planting can be done in belt system or in various size pits, depending on the site conditions and nature of seedlings, as it follows: planting in normal pits of 30 x 30 x 30 cm for the units where the preparation of soil in made in patches; planting in enlarged pits of 40 x 40 x 30 cm where other soil preparation is avoided.

CONCLUSIONS

The research carried out in the improvement perimeter of Tihuţa-Colibiţa concentrated on the observation of the behaviour of the afforestation works along the time and their impact on the environment in the studied area. In addition, it has also been studied the degree of fragmentation and the behaviour of runoffs within the perimeter.

The above analysed data allow highlighting the main causes that led to the emergence and development of the degradation phenomena within the studied perimeter.

These cases belong, on one hand, to the natural environment where the analyzed perimeter is located (geological, lithological and geomorphological complexes, climatic, hydrology and vegetation conditions) and, on the other hand, to the social and economic framework (utilities, administration and land use).

As a result of the synthesis of climate, it can be concluded: the climatic conditions within the improvement perimeter of Tihuţa-Colibiţa are favourable to the development of the degradation phenomena, such as those present in the studied area, namely the rainfall erosion and landslides.

The triggering of accelerated rainfall erosion is linked exclusively to the total or partial disappearance of the living soil cover after the intervention and action of some anthropogenic factors. The vegetation is the factor that ensures the stability of the land, preventing or limiting soil and rock mass movements on the slopes.

With a relief background characterised by rough topography with precipitous slopes, a heavy textured soil and a humid climate, the disappearance of the woody corresponding vegetation (structural, compositional and vegetation state) is the triggering causes of the degradation phenomena within the improvement perimeter of Tihuţa-Colibiţa.

Within the Tihuţa-Colibiţa perimeter, were decisive (in the development of the degradation phenomena) the disappearance of woody corresponding vegetation, which amplified the normal processes of runoff and concentration of water on slopes, processes that have led to the appearance of the gullying regressive to paedogenesis.

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GULLY SURVEYING USED FOR IMPACT ASSESSEMENT

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Abstract

Soil erosion is one of the greatest problem in agriculture, forestry and town-planning. Due to the continuous population growth towns are in a complex process of expansion, but when town expansion meets extreme deep soil erosion phenomena, this impediment is not only economical but also a social one and that is why gullies must be studied and monitored. This study is based on finding the technical data which defines the gully located in Cluj-Napoca in the La Cariera area and giving the solutions in order to stop the erosion, stabilize the gully and forecast its future behavior. The gully studied in this article is situated in the vicinity of the city of Cluj-Napoca and it is particularly important because in 10 years the city boundaries will overpass it and so these soil erosion phenomena must be integrated in the anthropic landscape.

Key words: erosion, gully, landscape.

INTRODUCTION

The deep soil erosion represents an important study domain, for many specialists. Gullies are formations of deep soil erosion which are intense studied because they occcupy great surfaces (Sevastel, 2014a). The studies of such formations invole the analysis of the factors that led to its formation (Sevastel, 2014b): [a] current state of erosion; [b] risk factors; [c] analysis of the natural landscape; [d] time monitoring of the ravine; [e] suggestions to stop evolution in time. The subject of this study is the ravine situated in Cluj County, in the area of the Cluj-Napoca City. Monitoring gullies is a topographical formation study, using GPS technology, classical measurements method and terrestrial laser scanning (Sevastel, 2002). In this study was used the classical method of lifting the three-dimensional detail. Because the gully is near the inhabited area of the city, is expected that in the near future it will be included in the intravillan. The study refers to the possibility of improvement and integration of erosion formations in the XXI century urban landscape.

MATERIALS AND METHODS

The gully is located in Cluj County, in the Cluj Napoca City (Figure 1).

Figure 1. Gully location – Cluj County, Cluj-Napoca City

In Table 1 are presented the aspects regarding the specific climate habitat:

Table 1. Climate parameters

Data reported by the weather station: **151200 (LRCL)** Latitude: **46.78** | Longitude: **23.56** | Altitude: **410**		
Data	**Valor**	**Computed days**
Annual average temperature:	**10.2°C**	365
Annual average maximum temperature:	**17.0°C**	365
Annual average minimum temperature:	**4.9°C**	365
Annual average humidity:	**75.4%**	363
Annual total precipitation:	**596.57 mm**	365
Annual average visibility:	**9 Km**	365
Annual average wind speed:	**8.6 km/h**	365
Total days with rain:		**159**
Total days with snow:		**45**
Total days with thunderstorm:		**35**
Total days with fog:		**60**
Total days with tornado or funnel cloud:		**0**
Total days with hail:		**2**

Source: http://www.tutiempo.net/en/Climate/

In this study we used, as we said classical methods in order to measure the gully's details with the total station Leica TCR 805. In order to study the current urban situation of the city of Cluj Napoca and to perform a series of maps and charts, there were used the General Urban Plan (*PUG*), Detailed Urban Plan (*PUD*), cadastral and ortophotomap of the area. Thus using the measurements made in the field phase of the project we obtained the topographical plan, longitudinal and transverse profiles (ProfLT application) (Figure 2), and model of the formation studied in Surfer 9 program (Figure 3) and AutoCAD extension TopoLT (Figure 4).

For the studied gully were calculated the status and risk factors in order to have a complete characterization and the possibility to highlight in detail the physical, morphological, hydrological properties, as follows:

- A relevant parameter in the gully forming is the hydroclimate coefficient (HTK), defined by Zachar D. (1982) quoted by Sevastel (2012; 2014b), so:

$$\text{HTK} = \frac{\Sigma P}{\Sigma T} * 10$$

ΣP - annual rainfall amount→ in the studied area is 596.57 mm

Σt – sum of the temperatures exceeding 10^oC on a year duration → in the studied area is $3{,}293.3^oC$

- status indicators on deep erosion

1. State of the terrain damage $= \frac{s}{S} * 100 [\%]$

Where: s = surface occupied by deep erosion formations [ha]; S = total area of land located in slope [ha]

2. State of fragmentation $= \frac{L`}{S}$ [km/km^2]

Where: L'= gully's total length [km]; S= total area of land located in slope [ha]

- Risk indicators on deep soil erosion – length growth [m/an]

$R = 0.15 \cdot A\text{^}0.49 \cdot S\text{^}0.14 \cdot P\text{^}0.74 \cdot E\text{^}1.02$

R – with drawl rate of gully [feet/year]
A – reception area of the gully's peak [acre]
S – gully's peak upstream hill slope[%]
P – the amount of rainfall in 24 hours greater than 12.7 mm
E – soil factor (clay content of the soil) [%]

- rate of fragmentation and hazard for upstream targets by the gully's peak advancing $= \frac{R_{ar}}{S_{fv}}$ [m/an·ha],

  R_{ar} = advancing rhythm of the gully's peak [m/an]; S_{vf} = reception surface of the peak [ha]

- factors which determine gully evolution

- control factors of the gully evolution

  $E = 6.87 \cdot 10^{-3} \cdot P^{1.34} \cdot S1 \cdot H^{0.52}$

P – annual volume of rainfall [mm]
S – reception surface [km^2]
H – gully's peak depth [m]

RESULTS AND DISCUSSIONS

Based on the obtained profiles we could calculate the volume of displaced by the soil-erosion formation. With the analytical method which considers the intersection between two transverse profiles and the longitudinal profile an irregular prism was obtained the volume's value of: 119686.128 m^3.

After the data interpretation on the studied estate from the Bulevardul Muncii – La Cariera zone, the terrain presents the most complex erosion formation, situated on a slope which faces southern part and it is partially wooded in the upstream part

The gully shows signs of that the erosion has stopped, as evidenced by installed vegetation on the thalweg and it is advancing only in width by the collapse of its banks in the median zone.

After literature classifications (Dîrja, 2000; Dîrja, 2006), the gully studied shows an average of 1-3 meters per year, is a slope one, in terms of development length, we deal with a short gully situated in 247.07 m a small basin with an area less than 10 ha. The gully shows a state of partial stabilization as evidenced above by installing both thalweg vegetation, mainly in the alluvial cone and on the steep banks of the gully. Loose rocks argillaceous nature present in the area affected by erosion in depth, made possible the development of intense deep ravine, which is very deep with an average depth of 19.5 m. Gully continue upstream with a rill that stretches from the top to the watershed. It was noted that technically the right bank shows a partial cessation the advance of the crumbling because this watershed was reached.
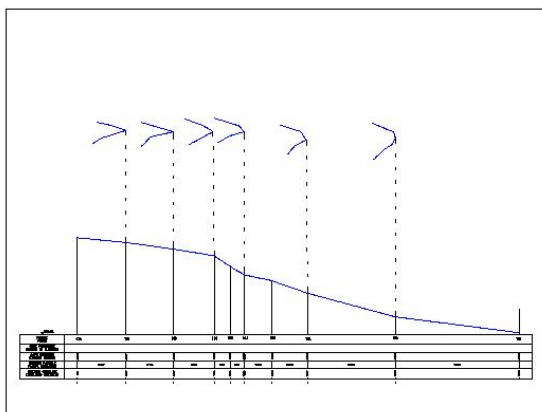
Figure 2. Longitudinal and transverse profiles
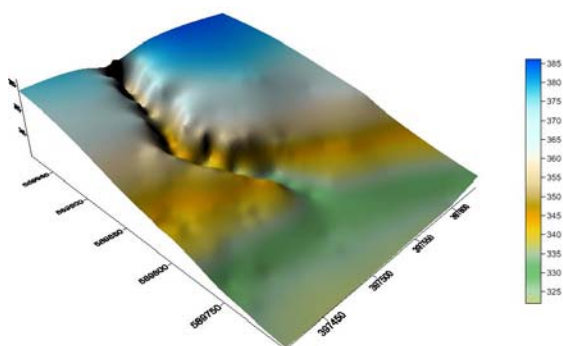
Figure 3. 3D model in the Surfer 9 application
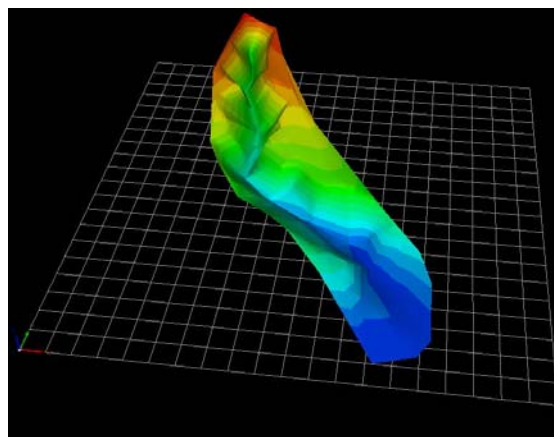
Figure 4. 3D model in the TopoLT extension
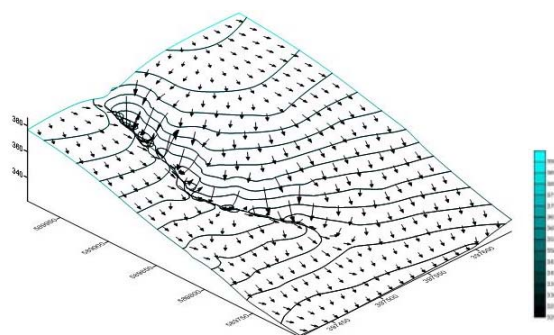
Figure 5. Direction of the water flow

The left technical bank continues developing and could be observed on the bank parallel cracks to the gully attesting to continuous erosion in the area. According thematic map (Figure 5) pointed direction drain water from precipitation on the slopes adjacent ravine on its banks. According to calculations based on the formulas presented above we concludes the following results:

Parameter	Value
Hydrothermally (HTK)	1.81
Status of surface damage	15.53%
Status fragmentation	0.044417[km/km^2]
Increase in length	13.499 [m/an]
Fragmentation rate	10.77 m/an pe ha
Controlling evolution of the gully	422.232 m^3

CONCLUSIONS AND RECOMANDATIONS

Due to massive growth in the constructed surfaces, we find that soon will become part of the intravillan, so it will be integrated into the

urban landscape and is finding use as well-defined in terms economic, social, etc. Based on all measurements, of the data, parameters calculated consider that erosion can be stopped by a ravine afforestation both perimeter and improvement. Also the technical value of the location was estimated using the method of assessment evaluation notes for three different cases. Behind determinations carried out it was determined that land value increases from 12.39 \$/m to 15.26 \$/m in case of urban expansion, values determined after methodology quoted by Dîrja and Palamariu (2008). And if the application of specific measures of land improvements (silvicultural measures) the estimated value of the land may even reach 26.32\$/m. Regarding the case study because the exhibition southern conditions of temperature and soil conditions, use a complex formula afforestation using three species: acacia (*Robina pseudacacia*) as the main species, oleaster (*Elaeagnus angustifolia*) as secondary species and Sea buckthorn (*Hippophae rhamnoides*) shrub species used successfully if eroded land amelioration, after the recommendations specified in Dirja (2000). Intimate mixture of species may be one form of pure alternate rows or grouped taking the form of bouquets of sizes between 10-25 m^2 and 50-100 m^2 or bands. Distances between saplings

differs depending on the species, so if the main species used 2x1 scheme will apply other distance between rows is 2 meters and the distance between saplings of one meter row (Norme tehnice, 2000). Based on the formula of afforestation and afforestation scheme elected will result in the number of saplings of each species per unit area (hectare):

Robina pseudacacia......3000 saplings/ha
Elaeagnus angustifolia..1500 saplings /ha
Hippophae rhamnoides .500 sapplingsi/ha

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LOCAL IRRIGATION SYSTEM USING THE WASTEWATER STORAGE TANKS IN RĂUŢI – SÂNMIHAIU GERMAN DRAINAGE UNIT, CENEI, TIMIS COUNTY

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Abstract

This paper aims to present the main features of a local sprinkler irrigation system in the draining unit Răuţi – Sânmihaiu German, Timiş county, using wastewater storage tanks from pig breeding complex Cenei that are transformed in water reservoirs used for application of irrigation on a land area of 450 ha.
The paper presents the pumping station, adduction from the river Bega-Veche, the storage tanks, the high pressure pumping station, the piping network for irrigation and the irrigation equipment.

Key words: irrigation, storage tanks, drainage unit, irrigation equipment.

INTRODUCTION

In context of aridisation and drought periods appeared in the western part of Romania, in order to increase crop yields on agricultural land, is found necessary to apply irrigation.

The studied area of 450 ha is located in the south-east of Cenei locality, Timis County, and south of the BegaVeche River.

The analyzed surface spatial overlaps with part of the draining unit Răuţi – Sânmihaiu German territory administered by the National Agency for Land Reclamation, Timis Branch, and in the same area are found the wastewater storage tanks under the administration of National Society for Land Reclamation, Banat Branch.

The existing works were originally designed and built in order to use wastewater from pig farm in Cenei for farmland irrigation, but the works were only partially completed.

Due to the environmental legislation, currently, the storage tanks can no longer fulfill their initial role so that it was brought to discussion the possibility of using them for another purpose, that of water reservoirs.

MATERIALS AND METHODS

In order to use the storage tanks for irrigation they must be brought to the initial projected characteristics.
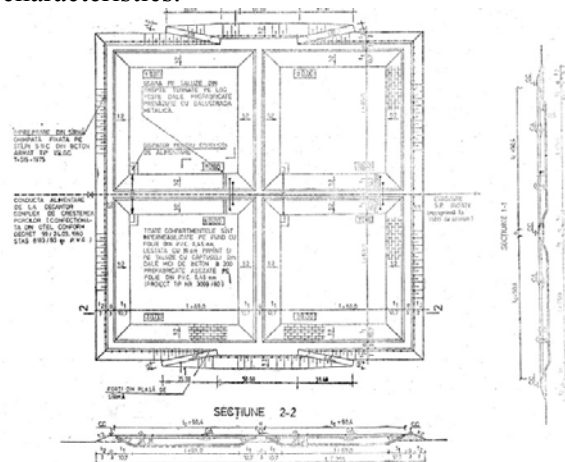
Figure 1.Initial design of storage tanks

Since the water supply source is different it is necessary to redesign the local irrigation system including the pumping station from the BegaVeche river, the adduction pipe, the high pressure pumping station, the piping network for irrigation and the irrigation equipment.
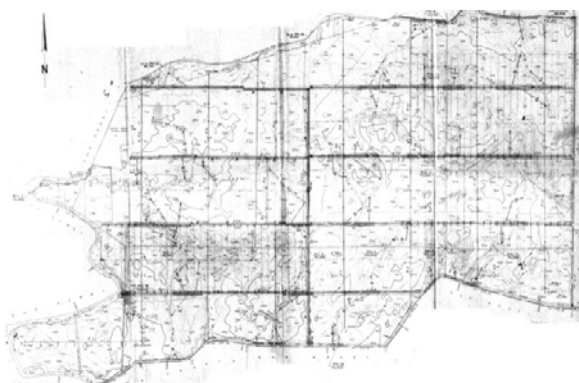
Figure 2. Initial design of the irrigation scheme

Regarding the average rate of multiannual monthly flow on Bega-Veche River it was examined the Cenei section.

For calculating the irrigation parameters were taken into account two crop rotations: wheat (planted on 25 % of the total surface) and corn (planted on 75 % of the total surface).

The irrigation scheme is calculated for a period of six months for each crop rotation.

Table 1.Irrigation scheme for crop per month

Month / Crop	IV	V	VI	VII	VIII	IX
wheat	1	2	0	0	0	0
corn	0	0	0	2	2	0

The irrigation norm are taken from tables based on experimental research in various stationary fields, representing monthly average daily consumption for the main plant during the growing season and irrigation water requirements for crop in research fields.

Table 2.Irrigation norm for crop

Crop	wheat	corn
H (m)	0,5	0,75
Ni (mc/ha)	1500	2800

Q_i - the entire surface flow rate is calculated with the following equation:

$$Q_i = q_i \cdot Si \ [l/s]$$

In which:

Si – irrigated area;

q_i - watering module determined by the formula:

$$q_i = \frac{m_{STAS}}{3,6 \cdot Ti \cdot ti}$$

Ti - 10 days – the time that is given to irrigate the entire area occupied by crop „i'';

ti – 20 hours - working time per day;

$m_{STAS:}$ - for wheat is 500 mc/ha;
  -   for corn is 700 mc/ha.

RESULTS AND DISCUSSIONS

The entire surface flow rate - Qi results are presented in table 3:

Table 3.Results for entire surface flow rate Qi

Crop	wheat	corn
Si (ha)	112,5	337,5
q_i (l/s/ha)	0,69	0,97
Q_i (l/s)	77,62	253,12

The hidromodul calculated in the month with maximum consumption is about 0,486 l/s/ha, in July or August.

Total flow required to be installed in the high pressure pumping station is about 219 l/s, in which case the hidromodule at the high pressure pumping station will be about 256 l/s·ha.

Calculations were made for a loss of 5 % on the pipeline network.

The pumping station will be dimensioned to cover the use of water from the high pressure pumping station, so that in the reservoirs will be a reserve of water at all time.

After the wastewater storage tanks will be rehabilitated to their use as reservoirs, the maximum amount of water storage will be around 400.000 mc.

The pumping station on the river Bega-Veche will consist of a heat pump unit mounted on a platform.

Table 4.Characteristics of pumping station

Pump type	Consumption (l/ora)	Diam. intake / Diam. pressure side (mm)	Characteristic points (l/min x bar)	Engine type
I22R501 Scova Italia	16,2	250/250	6000 x 1,8 11000 x 1,7 15000 x 1,1	Iveco 4 cil. 100 CP

The aduction pipe is made from PAFSIN and has a length of 900 m, from the river Bega Veche in straigth line to the reservoirs.

Table 5.Characteristics of the aduction pipe

Length (m)	Pipeline type	Dn (mm)	
		400	500
900	PAFSIN PN 6 SN 10000	96	432
	PAFSIN PN 16 SN 10000	-	372

The high pressure pumping station will consist of six heat pump unit mounted on a platform.

Table 6.Characteristics of high pressure pumping station

Pump type	Consumption (l/ora)	Diam. intake / Diam. pressure side (mm)	Characteristic points (l/min x bar)	Engine type
MPI 043	20,1	150/125	3500 x 10,4 4000 x 10 4500 x 9,2	Iveco 6 cil. 134 CP

The number of pump units that are connected to distribution pipeline network depends, knowing that a pumping unit provides favorable conditions for simultaneous operating of five irrigation installations type RAINSTAR 100equipped with rain wing AS 50 Ø 6,4 mm and with a rainfall nozzle of 25 mm at a pressure of 6 bar at hydrant.

Figure 3.RAINSTAR 100 irrigation installation

The pipeline network for irrigation is composed of two main distribution pipes and six secondary distribution pipes.

Table 7.Characteristics of the pipeline network

Pipeline	Length	Pipe type	Dn (mm) 315	355	400
A 1	600	PAFSIN PN 16 SN 10000	-	-	600
A 1-1	985	PEHD PE 100 SDR 17 PN 10		985	-
A 1-2	950	PEHD PE 100 SDR 17 PN 10	950	-	-
A 1-3	1600	PEHD PE 100 SDR 17 PN 10	-	1600	-
A 2	620	PAFSIN PN 16 SN 10000	-	-	620
A 2-1	1600	PEHD PE 100 SDR 17 PN 10	-	1600	-
A 2-2	260	PEHD PE 100 SDR 17 PN 10	-	260	-
A 2-3	1450	PEHD PE 100 SDR 17 PN 10	1450	-	-
TOTAL	8065	-	2400	4445	1220

Because the irrigation works overlap with part of Răuţi – Sânmihaiu German drainage unit the pipeline network will have to under cross the drainage channels.

Table 8.Characteristics of channels under cross

Pipeline	Number of under cross	Channel	Pipe type	Dn of under cross (mm)
CA	3	Hcn 1022/1 (CS5)	PAFSIN PN 16 SN 10000	500
		Hcn 1030/1 (CS6)	PAFSIN PN 16 SN 10000	500
		Hcn 1057/2 (CP2)	PAFSIN PN 16 SN 10000	400
A 1	2	Hcn 1057/2 (CP2)	PAFSIN PN 16 SN 10000	400
		Hcn 1030/1 (CS6)	PAFSIN PN 16 SN 10000	400
A 1-1	1	Hcn 1057/1 (CP1)	PEHD PE 100 SDR 17 PN 10	355
A 1-2	1	Hcn 1022/1 (CS5)	PEHD PE 100 SDR 17 PN 10	315
A 2	2	Hcn 1035/1(CS7)	PAFSIN PN 16 SN 10000	400
		Hcn 1047/1(CS8)	PAFSIN PN 16 SN 10000	400
A 2-1	1	Hcn 1035/1(CS7)	PEHD PE 100 SDR 17 PN 10	355
A 2-3	1	Hcn 1057/2 (CP2)	PEHD PE 100 SDR 17 PN 10	315
TOTAL	11	-	-	-

The new irrigation scheme will cover an area of 450 ha around the reservoirs.

Figure 4. New design of the irrigation scheme

CONCLUSIONS

The studied area of 450 ha can be irrigated using the rehabilitated wastewater storage tanks avoiding environmental problems and using Bega-Veche River as a water source.

The new irrigation scheme can be implemented using innovative materials and irrigation installations making it easier to operate and to maintain.

Taking into account that part of the work should only be rehabilitated the investment costs will be reduced.

Because the analyzed surface spatial overlaps with part of draining unit Rauti–Sanmihaiu German territory irrigation works can give a higher efficiency.

Works will not negatively affect Rauti–Sanmihaiu German drainage unit, maintaining the draining management plan at maximum efficiency, ensuring maintenance for the channels network.

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INTEGRATED WASTE MANAGEMENT SYSTEM IN CARAS-SEVERIN COUNTY

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Abstract

To comply with national and European legislation on waste management in Caraş-Severin county is necessary to implement an integrated waste management system. This implies the existence of an institutional structure at county level: establishment of Intercommunity Development Association, Project Implementation Unit, which ensure implementation of the project: building ecological central warehouse and three transfer stations, closure of rural and urban non-compliant deposits.
The total costs of the project funded through the FEADR, state and local budget, is 18.639.807.000 lei, and the implementation period is 2012-2015.

Key words: waste management, transfer stations, landfill, sorting station, environmental infrastructure

INTRODUCTION

In order to reach the strategic objectives and the targets written in the Accession Treaty and in the waste management plans, it is necessary to implement an integrated waste management system in the county.

The assessment of the present waste management system in Caraş-Severin county led to the following conclusions:

- the present waste management system does not assure the conformity with the European and national legislation in the field;
- storing waste in non-conform depositing sites has a negative impact upon the environment (soil, water, air);
- there are not enough facilities for the selective waste collecting;
- the failure to treat biodegradable waste, dumped in non-conform depositing sites, represents a menace for the environment, by the release of leachate and biogas;
- the waste recycling degree is very low;
- the population's awareness in the domain of waste collection is relatively poor;
- the selective collection covers a narrow range (generally in the urban environment and the institutions in the rural milieu);
- the equipment used is obsolete and insufficient etc.
- limited expertise of local authorities in managing and monitoring the husbandry services, due to:
  - insufficient specialised staff, including in key fields such as: project management, public procurement etc.
  - absence of a medium and long-term strategies of sustainable local development on the local level.

In view of solving these problems, the integrated waste management system in Caraş-Severin county represents a requirement in order to conform and reach the targets set by national and European legislation for ensuring a sustainable development of local communities and improving citizens living conditions.

The conclusion drawn from all above is that the present waste management system in Caraş-Severin county is flawed and is not in accordance with the relevant national and European legislation.

INSTITUTIONAL FRAME ON THE NATIONAL AND LOCAL LEVEL

The main institutions with responsibilities in the domain of waste management on the

national, county and local level are shown in Figure 1.
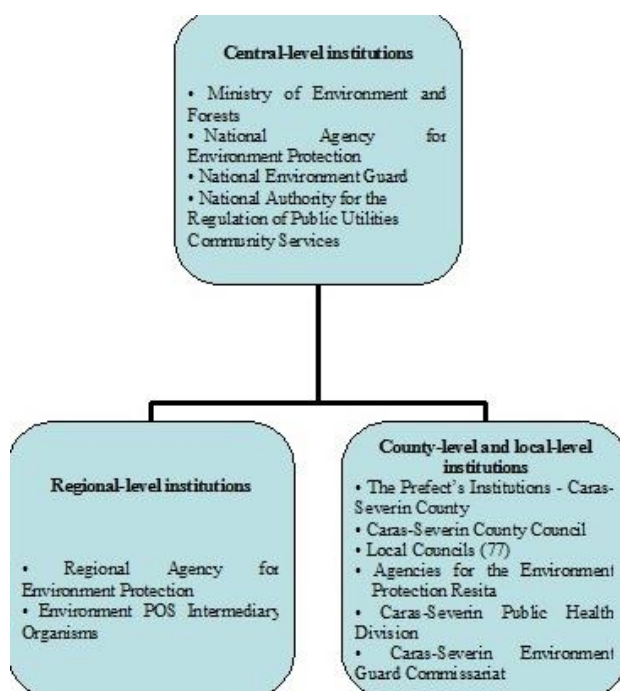
Figure 1. Institutions with responsibilities in the field of waste management

PROJECT CONTEXT

Caraș-Severin County belongs to Development Region 5 West, and has a surface of 8,519.76 km² (26.59% of the total region surface) and a population of 317,674 inhabitants, of which 56% live in the urban area, and the rest of 44% in the rural milieu.

Its preponderantly mountainous relief 65.4%, low population density 37.4 inhabitants/km², along with the high degree of localities dissipation represent the major particularities of the county population's settlements.

Administratively, the county comprises 8 municipalities/towns and 69 communes containing 285 localities.

As regards the existing infrastructure in the field of waste management, the situation is the following:

- The present system of waste management consists in the collection and transport of waste to the Reșița Waste Sorting and Transfer Station;
- In July 2009 all rural waste dumping areas were closed in the 69 communes and the necessary ecologisation works were effected;

- All 69 communes are serviced by husbandry services;
- The rate of connection to the husbandry service is of 100% in the urban area and 99% in the rural zone;
- For 3 towns (Băile Herculane, Caransebeș, Oravița) and 23 communes waste operators were established, through PHARE projects: SC Ecologica Văliug SRL, SC Ecologica Oravița SRL and SC Ecologica Băile Herculane SRL; All three societies carry on activity of waste collection and transport in all ascribed localities;
- The selective waste collecting is not practised, except the areas covered by the companies established through PHARE projects, which have introduced selective collection in the county:
  - SC ECOLOGICA BĂILE HERCULANE SRL (1 town and 7 communes) serves about 24,200 inhabitants;
  - SC ECOLOGICA ORAVITA SRL (1 town and 12 communes) provides serves around 28,600 inhabitants;
  - SC ECOLOGICA VALIUG SRL (2 communes) at the service of 2,800 inhabitants;
  - CARANSEBEȘ WASTE MANAGEMENT SYSTEM offers services to about 29,000 inhabitants;
- Waste is collected in most cases in a mixed regime and transported to depositing sites;
- Waste collection is generally made from household to household at a pace varying from one locality to the next; the private operators (16) set up special points for recyclable waste collecting (paper and cardboard, plastic and metal, and glass, DEEE etc.) and in time a market of recyclables has emerged;
- There are no sorting and transfer stations, except those built within the PHARE projects: Oravița, Băile Herculane and Văliug;
- The waste collecting and transport equipment is insufficient and outdated for an appropriate management of the entire quantity of waste generated in the county;
- There are 5 recycling companies, but the selective collection of recyclables is absent.

The specific targets related to the waste recycling and profitable use, as they were settled in the national and European legislation, cannot be reached in the absence of the implementation of an adequate integrated waste management system in Caraş-Severin county, with focus on their selective collection.

In Caras-Severin there are no sorting stations, except several small manual sorting stations for the recovery of metals, paper and cardboard and plastic. The two storing ministations in Oravita and Baile Herculane built through PHARE projects cover approximately 16% of the county population.

Furthermore, there is no facility of waste composting and no organised system of biodegradable waste treatment in the county, the waste collected was deposited in non-conform closed urban and rural dumping sites. The urban depositing sites that are to be ecologised within the project Integrated waste management system in Caraş-Severin county are: Băile Herculane – closed in 2009, Caransebeş – ceased in 2009, Reşiţa – closed in 2009, Anina – ceased, Bocşa – stopped in 2011, Oţelu Roşu – ceased in 2011, Moldova Nouă – closed in 2012 and Oraviţa – closed in 2012;

To conclude, the reaching of the strategic objective and of the targets stipulated in the Accession Treaty, as well as in the waste management plans (PNGD, PRGD, PJGD) can be accomplished only by implementing a system of integrated waste management throughout the county.

INTEGRATED WASTE MANAGEMENT SYSTEM IN CARAS-SEVERIN COUNTY (SIMD)

The financing and implementation of the integrated waste management system in the county is funded by the Environment POS Programme.

For this purpose, investments are proposed, meant to assure the reaching of the following objectives:
- The expansion of the selective collection system in the urban and rural area;
- Modernisation of the collection and transport equipment;

- Enhancement of the waste management system by building 3 transfer stations in the localities Oţelu Roşu, Pojejena and Bozovici, a Centre for the Integrated Waste Management in Lupac – ecological depositing site, sorting station (34,000 t/year) and simple mechanic-biologic treatment station (64,000t/year);
- Controlled depositing of waste etc.

The entire infrastructure to be built within the SIMD projects will become part of the public domain of Caras-Severin county.

The SIMD design took into consideration the main strategic documents on the national, regional and local level:
- National Waste Management Plan (PNGD);
- Regional Waste Management Plan (PRGD);
- County Waste Management Plan (PJGD);
- Environment Operational Sector Programme.

In order to collect waste, according to the County Waste Management Plan, one assigned to Caraş-Severin county 7 collection zones, presented in figure 2.

Figure 2. Waste collection zones in Caraş-Severin county

The targets for the recycling and profitable use of packing waste are shown in Table 1.

As for the treatment of waste, the main objective consist in the reduction of the quantity of biodegradable waste from depositing sites. The specific targets in this respect are the following:

- treatment of 30,000 t of biodegradable waste in 2013;
- treatment of 41,000 t of biodegradable waste in 2016.

Table 1. The targets for the packing waste in Caras-Severin county

Paper and cardboard (t)	5,821
Plastic (t)	1,884
Glass (t)	4,041
Metals (t)	911
Wood (t)	640
Total recycling (t)	16,994
Total sale (t)	18,539

–

Romania's strategy and policy aims at the regionalisation of husbandry services, and the main elements of this process and implicitly of SIMD in Caras-Severin county refer to:

- Establishment of the Association of Intercommunity Development "INTERCOM Deseuri Caras-Severin/INTERCOM Waste Caras-Severin" (ADI Intercom) in 2009, with the following members: Caraş-Severin County Council, the Local Councils of the 8 cities and towns and the Local Councils of all 69 communes;
- Signing the Position Document for the System Implementation;
- Constitution of the Project Implementation Unit within the Caraş-Severin County Council;
- Granting procedure for the 12 contracts of services and works (closure and ecologisation of waste rural and urban dumping areas, 3 transfer stations, Centre for the Integrated Waste Management (CMID), supply of collection and transport equipment, public awareness and information for the implementation of SIMD, audit etc).

The ecological depositing site is situated on the Lupac village location, around 6 km west from Reşiţa and it will consist in two cells – phases, the first phase requiring 126,924 m^3 of excavations and 124,367 m^3 fillings for the configuration of the surface necessary to CMID. The surface of the first cell will be around 32,885 m^2 and will have a total capacity of approximately 495,938 m^3, of which 431,250 m^3 will be the depositing volume. The basin slope is 33%, uniform for the entire surface of the first cell, whereas the estimated life duration is about 6.5 years.

Its components are the following:

- The proper deposing site (the depositing space);
- The leachate caption and drainage system;
- Leachate operation station with 2 steps:
  • Mechanic step – for the pH level reduction and pre-filtering;
  • Biologic step – for proper treatment by osmosis and nano-filtering.

The leachate collected from inside the deposit is drained, through the layer and draining pipes, located at the basis of the deposit and gravitationally led by collectors toward the closed storage and retention tank, and then treated in the leachate purging station.

Caraş-Severin County Council will be the main stakeholder in the management and implementation of the investments necessary for the realisation of SIMD. For each type of completed facility: sorting station/transfer station/compost making station/depositing site, Caraş-Severin County Council must put at disposal the afferent lands and must participate in the co-financing of the project, as well as the financing of the ineligible expenditure within the project.

According to the grant contract, the total value of the project is 186,398,069 lei, of which eligible costs according to Environment POS 160,733,138 lei and ineligible costs 25,664,931 lei. The following categories will be granted by public tender:

- 7 contracts for the waste collection and transport;
- 1 contract for the operation of the 3 transfer stations that will be erected in the project: Oţelu Roşu 8388 to/year, Pojejena 9060 to/year and Bozovici 3400 to/year and of CMID Lupac, including long-distance transport from transfer stations to depositing site.

At present, there are 16 husbandry operators, of which 9 private and 7 public.

The purpose of the integrated waste management system is to ensure an integrated approach on the county level, in order to improve quality and ensure homogeneity of

husbandry services and conformation to the national and European legislation.

The procedure of granting the contracts for the operation of facilities (the 3 transfer stations) and the transport of waste from them to the central CMID depositing site will be organised by Caraș-Severin County Council in its own name.

For the year 2015, according to the Annual Plan of Tariff Evolution enclosed to the SMID projects, the tariffs for the urban area must not exceed 9.61 lei/inhabitant/month, and 7.19 lei/inhabitant/month for the rural area.

One of the main drawbacks of the system consists in the low percentage of tariff collection, especially in rural zones.

The proposed payment mechanisms should cover the operation and upkeep costs for all the system components: collection, transport, treatment, sorting, storage.

The future tariffs will take into account the population's affordability degree: 1.8% of the income of the poorest family.

The integrated waste management system will introduce new waste management practices: new management technologies, a new financial frame and new roles and responsibilities from the institutional viewpoint.

The efficiency of the new waste management system will suppose a high degree of comprehension and acceptance from the part of the public and of the other interested stakeholders. In this respect, raising public awareness will be necessary in all the project phase.

CONCLUSIONS

At present, the project Integrated waste management system in Caraș-Severin county is under implementation, as follows:
- The Lupac conform depositing site (CMID) is in the stage of granting the works contract;
- The construction of the 3 transfer stations (Oțelu Roșu, Pojejena, Bozovici) is in the stage of evaluation of submitted offers;
- The closure and ecologisation of urban waste dumping sites is in the stage of evaluation of submitted offers;

The services contract for the public information and awareness was signed.

From the institutional point of view, in Caraș-Severin county it is functional, the main requirements of the regionalisation process have been fulfilled:
- Establishment of the Association of Intercommunity Development ADI Intercom;
- Establishment of the Project Implementation Unit;
- Signing of the Position Document for the Project Implementation.

As regards the PHARE projects, it was decided to integrate them into the new integrated waste management system after the cease of the conditions imposed in the PHARE Grant (2014).

All these decisions related to the operation modality were accordingly reflected in the position document conclude on the level of Caras-Severin county.

The conclusion to be drawn is that the integrated approach on the county level represents an efficient and viable system of waste management, able to reach the specific targets regarding the waste profitable use and recycling, set in the national and European legislation, and the improvement of the husbandry services quality.

The main purpose of closing the ecological depositing site is to minimise the water infiltration into waste and consequently to reduce the quantity of leachate released.

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The documentation of granting the works contract for the Construction of the Centre of Integrated Waste Management in Caraș-Severin county within the project "Integrated waste management system in Caras-Severin county".

SECTION 02
ENVIRONMENTAL ENGINEERING

RESEARCHES ON ECOLOGICAL RECONSTRUCTION OF BOUNDARY FOREST IN PIETROSUL RODNEI MASSIVE

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Abstract

The present paper aims to evaluate the outcome and the progress of the ecological reconstruction works carried out in the old stand of the Pietrosul Rodnei massive by analyzing the variance for the main morphometrical characters of the installed seedlings. The afforestation composition was represented mainly by the Pinus cembra seedlings. In order to achieve the above mentioned target, one used the grid method to set up sample surfaces of 200 m², realized the inventory of seedlings for each sample area and carried out the following measurements: the overall height of the seedlings, their growth recorded during the 2012-2013 vegetation season and their stem base diameter. The results of the measurements were statistically processed by calculating the coefficients of variation for different characters, as well as correlations between elements, the regression equations and by calculating the coefficient of regression. After analyzing the registered data, one concluded that all elements present a high and very high variability of the characters, due to the genetic diversity of origins, therefore the future of the newly installed stand is ensured and a proper and successful selection of tree can be performed + improving all analyzed characters, highlighting the elites and increasing the value of the stand. Following the performed correlations, one noticed a direct and distinct significant link between the height of seedlings and their stem base diameter. The differences between the average growth of the two analyzed seasons are differentiated on sample groups of sample markets. After carrying out the research and analyzing the obtained results, one can conclude the success and the opportunity of restoring old stands, as well as the ecological reconstruction of the area studied.

Key words: Ecological reconstruction, sample markets, seedlings, stand.

INTRODUCTION

One of the most complex ecosystems on Earth with a huge impact on human life is the forest. The forest has been a resource of raw materials for humans; it provides wood used in various usages; it is a shelter and food provider. But the most important role of the forest is about that it influences all climatic factors. Erosion and degradation occurs at a much higher intensity than in other areas due to excessive frequency and aggressiveness of climatic factors correlated with high slopes and high energies of the relief. Knowing that the significant amounts of rainfall occur in these regions, the forest has the role to retain a large quantity of the water over the vegetation canopy and especially at ground level via the root system and different mosses living in symbiosis with trees and shrubs species and acting like a real " living sponge" absorbing an appreciable amount of water. (Savulescu, Negulescu, 1967) Action factors that led to the degradation stands at the upper limit of vegetation can be evidenced by the negative consequences, materialized into: a) torrential phenomena; b) accelerated erosion; c) landslides; d) disappearance of some endemic plant species, e) regressing of natural range; f) decreasing of animal livestock; g) landscape degradation, h) increasing windfalls in the stands at the upper and middle slopes etc. (Taras George Seghedin, 1979.)

To remove these negative effects is needed restoration stands at the upper limit of vegetation. In this paper are presented the studies, which were conducted in Picioru Mosului (UP VI Pietrosu), where were observed the natural and artificial regeneration evolution of the best represented species in the

upper limit of the forest.(Amenajament UP VI Pietrosu,2008)

The objectives of the paper are: a) results and evolution of the ecological reconstruction assessment upon the boundary stand from the massive Pietrosul Rodnei by analyzing the variation of the main taxatoric characters of Swiss stone pine installed seedlings; b) the height increasing progress from the last two seasons (2012 and 2013); c) taxonomy elements variability assessment of seedlings; d) setting characteristics of Swiss stone pine seedlings specific of the studied area; e) correlations establish between seedling height and diameter at their root crow.

MATERIALS AND METHODS

To achieve the paper objectives, to have a relevant statistical coverage, were located a total of 10 samples, with circular form; each one with an area of 200 m^2, in total 8% of the studied area (Norme Tehnice ,2000); within each being assessed 15 Swiss stone pines (*Pinus cembra*) seedlings on which were determined the following elements: a) seedlings total height, measured from root crow to terminal-bud, b) the seedlings development from the last growing season; c) the seedlings development from two growing seasons; d) seedlings root crown diameter.

The values mentioned above from point a) to point c) were determined using a tape measure with a millimeter precision, and for the root crow diameter was used a caliper with a tenth of a millimeter accuracy.

The delimitation of sampling surfaces was taken with the help of a string. The average slope determined was about 30° and from The Technical Norms results a total string length of 8.57 m, with a corresponding 200 m^2 sampling surface.

The measurement results were statistically processed by calculating the variation coefficients of different characters, and also were made correlations between elements exposing their regression equations and the calculation of the regression coefficient. (Ardelean M., 2006.)

RESULTS AND DISCUSSIONS
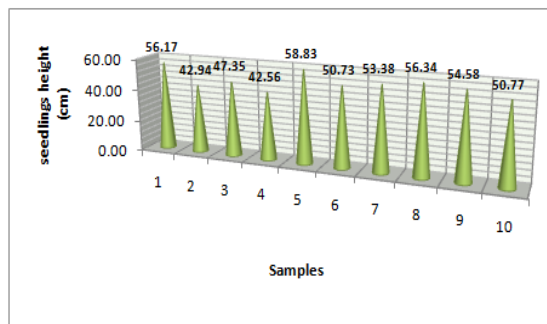
Figure 1. The differences between average heights of the seedlings

After analyzing figure 1, it could be observed that the highest values of seedlings height record for 5th, 1st and 8th samples, these being located in the middle area of the slope. The lowest values were registered for the 2nd, 3rd and 4th samples; these being located in the upper area of the slope. Showing this result it could be conclude that the orography influences the seedlings height.
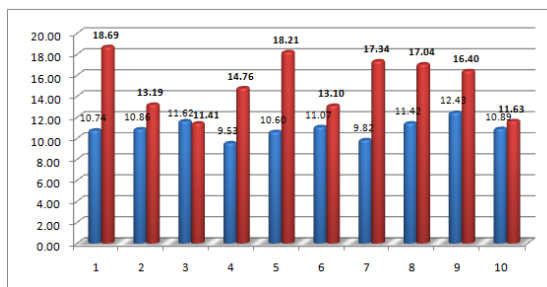
Figure 2. The seedlings growing [icon] the seedlings development from the last growing season; [icon] the seedlings development from two growing seasons

In the last growing season the highest values were determine for the seedling from 9th, 8th and 3rd samples, and the lowest values were for in the 4th sample (Figure 2). The growth from the last two growing seasons has the same trend, obviously because the placement inside the slope influences this character.

Also there is a growing difference between the two years; in 2012 the growing is significant highest then the growing from 2013, in all the samples, with exception of the 3rd sample. The differences between the two seasons is determined by climatic factors variations.

Table 1. Synthesis for coefficient of variation (CV%) for measured characters

CV %	Samples									
	1	2	3	4	5	6	7	8	9	10
	Total height (cm)									
CV %	173.99	506.58	670.03	312.07	385.01	251.63	295.72	421.04	247.53	470.69
	The seedlings development from the last growing season – 2013									
CV %	85.75	107.17	80.92	145.20	136.19	110.07	62.98	68.03	55.09	39.06
	The seedlings development from two growing seasons – 2012									
CV %	46.38	177.47	163.42	109.74	80.94	98.82	164.47	181.83	107.42	79.39
	Root crow diameter (mm)									
CV %	43.89	39.74	107.92	68.71	102.36	71.00	87.94	131.49	47.83	20.05

Legend: CV means coefficient of variation

Analyzing data showed in table 1, according with appreciation scale for variation coefficient described by (M. Ardeleanu 2006), it could be concluded:

- Regarding the seedlings total height , variation coefficient for each sample, has very high values (CV%>30);
- Regarding the growth from the last growing season, the variability is very high, the same with seedlings height;
- The highest value of variation coefficient of the growth from the last seasons is registered for 8th sample (CV%=181.83%), followed by 2nd and 7th sample; in all samples the coefficient being very high;
- Analyzing the values of variation coefficient regarding root crown diameter, it could be concluded that the variability of this character in the 10th sample is high (20%<CV%<30%), but this values being the smallest, followed by the 2nd sample with CV%>30%. In all other samples the variation coefficient has higher than 30% values, the character variability being high.
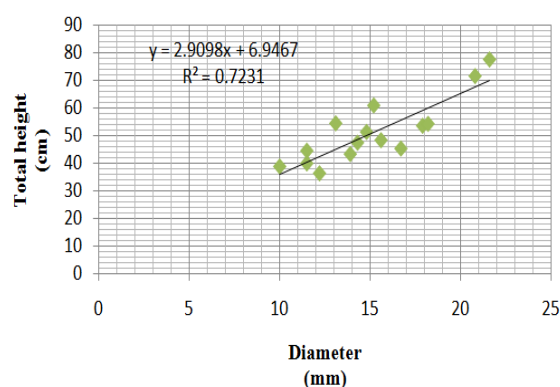
Figure 3. Correlation between height and root crown for 6th sample

Analyzing data showed in figure 3 it could be observed that between the two characters (seedlings total height and root crown diameter), after the comparison of "r" correlation coefficient values ($\sqrt{r^2} = 0.723$ – calculated obtained), with table values of "r" for transgression probabilities of 5% and 1%, for GL=14 (Ardelean, M. (2006) exists a directly and significant link. Analyzing the regression equation between those two characteristics ($y = 2.9098 * x + 6.9467$), it is establish that the seedlings from 6th sample, with a increasing of 1 mm at root crown, the height increase with 9.85 cm.
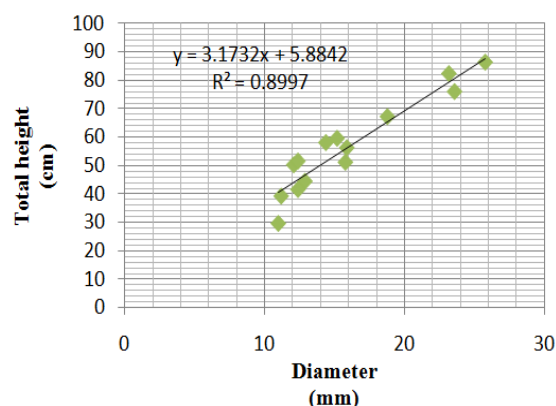
Figure 4. Correlation between height and root crown for 8th sample

Analyzing the value of "r" correlation coefficient (Figure 4), results that between average of seedlings height and root crown diameter exists a directly and distinct significant link. Also, between those two characters was established o linear simple regression, this one being exposed by regression equation $y = 3.1732x + 5.8842$.

Regarding with the regression equation, it could be established that for each millimeter of root crown diameter, the height of the seedlings increases with 9.05 cm.

CONCLUSIONS

1. The differences between the heights were significantly, influenced by the seedlings total height, as well as the zonal micro-relief. Thus, significant variations were observed at seedlings located in concaved and convex areas, which were generated by the stream and rock localized in the plantation.

2. The samples located in the upper area of the plantation, although this area has an extremely small edaphic volume plantation, the presence of the rocks making difficult the installation of woody vegetation, due to lack of competition from other species such as woody and herbaceous, Swiss stone pine vegetates very well in such conditions. Also placing seedlings in this area affected very well their development and the micro-relief influenced the height growing, observing a notable difference among these values.

3. Regarding the seedlings height, in all samples variability of this character was high and very high, hence the conclusion that the choice to promote elite in terms of this character, it is possible.

4. Also, the root crown diameter has a large and very high variability of this character, so it's successfully being able to make the choice to promote valuable items. Large variability of these elements has genetic determinism; the plantation was established with seedlings from several origins.

5. According with the correlations, it was found there in all samples is a direct link and distinct significant between seedling height and root crown diameter. The differences between the average growth of the two seasons are analyzed are differentiated on sample groups. After this research, it can be concluded the success and opportunity restoring old stands and reconstruction of the area studied.

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MEASUREMENT OF DRY DEPOSITION AMOUNT OF PAHS IN ZONGULDAK REGION

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Abstract

Polyaromatic hydrocarbons (PAHs) consist of more than two unsubstituted benzene rings. They can be found in all media and some of them are cancerogenic. Polyaromatic hydrocarbons (PAHs) are formed during incomplete combustion of organic matter (i.e., coal, oil, gasoline, diesel fuel, garbage, and tobacco).
Increased concentrations of air pollutants caused by domestic heating, industrial activities, traffic and atmospheric transport in the city environments have been damaging air quality. Increased concentrations of air pollutants also cause health problems.
Zonguldak region has an important place in Turkey because of having large coal fields and coal production. However Catalagzı Thermal Power Plant , Eregli Steel Plant and usage of coal and wood in the region makes a potential input for PAHs in high concentrations.
In first stage of the study, calibration of PAH standards were made and PAH samples were collected periodically from 5 different sample collection points. In second stage of the study collected samples will be analysed.
This study will be a preliminary study for literature with measuring the concentration of dry deposition of PAHs. In addition, data obtained from the analyses will be used in preparing density map of PAH concentration and this will help us for detecting the effective source of pollutants.

Key words: domestic heating, dry deposition, industrial activities, PAHs, Zonguldak region.

INTRODUCTION

Concentrations of particulate matter in the ambient air are typically composed of complex mixtures of chemical species, originating from a wide range of natural sources and human activities.

Among the organic compounds of anthropogenic origin, polycyclic aromatic hydrocarbons (PAHs) make up a significant group. Polycyclic aromatic hydrocarbons are a class of aromatic compounds found in ambient particulate matter and shown by several investigators to be carcinogenic and/or mutagenic.

PAHs are formed during incomplete combustion or pyrolysis of organic material and are related to the use of oil, gas, coal and wood in energy production. Other contributors to ambient air levels include indoor smoking and heating (WHO, 1987).

Lots of PAHs are in environment but 16 of them are at preferential list of EPA. They are acenaphthene, acenaphthylene, anthracene, benz[a]anthracene, benzo[a]pyrene, benzo[e]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[j]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz(ah)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene (EPA 2003).

High concentrations of atmospheric PAH exist in the urban environment, because of high domestic heating, vehicle density, industrial activities and dispersion of atmospheric pollutants.

Dry deposition is a major pathway for PAH transfers from air to land and water. Interest in atmospheric deposition has grown over the past decade because of concerns regarding the health effects resulting from the deposited material entering the environment.

In Turkey a few studies have been made about dry deposition of PAHs. One of them is about an industry region in Bursa province,

measuring the dry deposition flux of PAHs as 3300 ± 5100 ngm^{-2} d^{-1} (Esen et al., 2007).

Again in 2007, in Izmir region a study was carried out about 15 PAHs, measuring for summer and winter periods. Results were given as 5792 ± 3516 ngm^{-2} day^{-1} and 2650 ± 1829 ngm^{-2} day^{-1} respectively for the season (Bozlaker et al., 2007).

Zonguldak province has hard coal deposits. There are two thermal power plants and one iron & steel plant in Zonguldak region. In addition to the industrial sources, domestic heating and increasing number of vehicles features air pollution studies in Zonguldak region. It is thought that PAHs concentrations can be high in this region but only one study about PAHs has been carried out at one point with an air sampler. PAH concentrations have been measured as 22.9 ngm^{-3} and 464 ngm^{-3} respectively for summer and winter periods (Akyuz and Cabuk, 2008).

Dry deposition in the region has not been studied and it will show the effective pollution sources.

MATERIALS AND METHODS

Sampling

To determine amount of PAH compounds, dry deposition sampling will be performed between July-August period with no rain. To avoid rain gush, sampling will be performed from 9 am to 9 pm everyday. Sampling period will be repeated every 5 day to get sufficient sample volume.

5 sampling points were determined between Kozlu and Çatalağzı, having distance approximately 20 km. Projected sampling points were given in Figure 1.

Figure 1. Sampling points

Dry deposition samples will be collected with a stainless steel pot whose diameter and depth is 60.5 cm and 19 cm, respectively. There is a 20 cm long leading edge around the sampler to minimize air flow disruptions caused by shape of the collector as used in the previous studies (Vardar et al., 2004; Tasdemir and Esen, 2006; Esen et al., 2006).
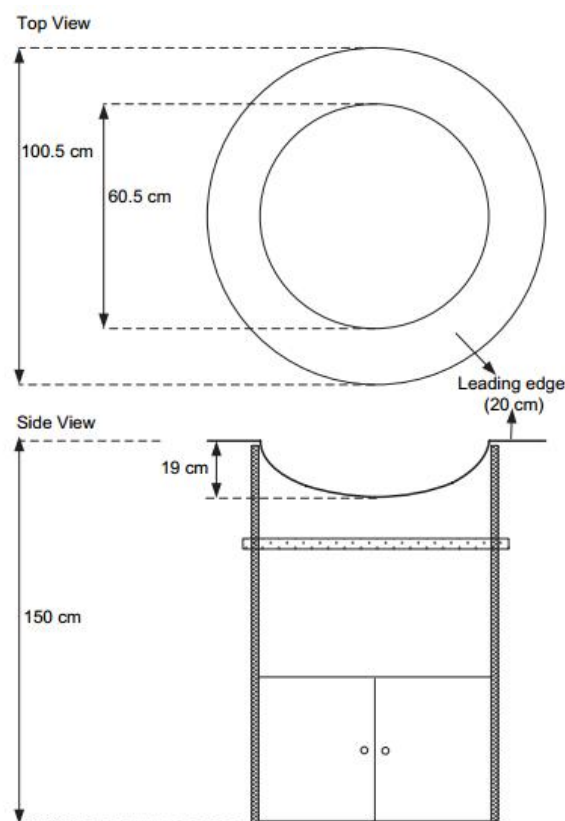
Figure 2. Side and top views of sampler

Extraction and analysis

At the end of each sampling period, the surface of bulk sampler is rinsed with DI water and MeOH sequentially and both of them is collected as a sample. The surface is then be wiped with a clean wiper and it is added into the sample. Samples are spiked with PAH surrogate standards and extracted with MEOH and DCM sequentially for 24 h for each solvent, respectively (Odabasi et al., 1999b; Tasdemir and Holsen, 2005; Tasdemir and Holsen, 2005; Esen, 2006). The MeOH and DCM extracts are combined and then concentrated to 5 ml with a rotary evaporator. Then the solvent is exchanged to HEX and

concentrated to 2 ml with a gentle stream of nitrogen.

Samples are spiked with PAH surrogate standards before extraction to determine analytical recovery efficiencies.

The collected samples are analysed for 15 individual PAHs: acenaphthalene (ACE), acenaphthene (ACT), fluorene (FLN), phenanthrene (PHE), anthra cene (ANT), fluoranthene (FL), pyrene (PY), benz[a]anthracene (BaA), chrysene (CHR), benzo[b]fluoranthene (BbF), benzo[k]fluoranthene (BkF), benzo[a]pyrene (BaP), indeno(1,2,3-cd)pyrene (IcdP), dibenzo[a,h]anthracene (DahA), benzo[g,h,i]perylene (BghiP).

Samples will be analysed with Thermo Scientific TRACE™ Ultra gas chromatograph (GC) with flame ionization detector (FID) equipped with 30 m x 0.25 mm and 0.25 mm thickness TR5-MS column.

RESULTS AND DISCUSSIONS

Collected PAH samples will be analysed to determine sources and deposition fluxes into Zonguldak region. High and low concentrations of PAHs are being assumed with variations of sampling points. Points are considered for both industrial and urban sites. Traffic and atmospheric effects will also be remarked.

Due to lack of such a study in this region, effects of industry, domestic heating and traffic on human health will be discussed. Studies on dry deposition in the literature is given at Table 1 and Table 2.

In preliminary study, PAH calibration in GC was done with r^2 0,999169. Calibration curve and method procedure were given at Figure 3, 4. Peaks and calibration curve were given at Figure 5 and 6.

Table 1. Ambient air concentrations of individual PAHs in the combined gas and particle phases and comparison with measurements in the literature (ng m^{-3}) (Birgül et al., 2011).

Sampling site	Period	Phe	Ant	Flt	Pyr	BaA	Chr	BbF	BkF	BaP	IcdP	DahA	BghiP
Tainan, Taiwan	Mar-96	4.5	0.4	1.7	0.9	1.4	0.5	0.9	0.7	10.3	0.3	2.4	3.7
Seoul, Korea	Oct-98 Dec-99	16.4	2.7	8.1	12.5	2.6	3.6	4.8	2.5	3.5	0.5	3.2	
Gandy Bridge USA	Aug-02	15.7	0.5	5.9	2.4	0.05	0.5	0.1	0.02	0.01	0.04	0.01	0.1
Heraklion, Greece	Nov-00 Feb-02	20	3.3	4.9	6.6	1.1	3.1	1.5	1.8	1.2	2.5	0.1	3.4
BUTAL, Bursa Turkey	Aug-04 May-05	76.2	7	47.8	31.1	4.7	10.6	5.8	4.7	3.3	3.9	1.3	5.6
Singapore	Nov-06 Dec-06	7.2	2	5.6	7.3	0.5	0.9	1.2	0.2	0.5	0.8	0.07	1
BUTAL, Bursa Turkey	Sept-08 Jun-09	73.7	6.4	23.6	19.3	4.2	4.2	3.5	2.8	3.1	2.1	0.3	2.2

Chr/triphenylene

Table 2. Comparison of the dry deposition PAHs fluxes measurement (Pekey et al., 2007).

Location	Season	PAHs flux µg m^{-2}day^{-1}
Izmit Bay, Turkey	Summer	1.3
Seoul, Korea	Spring	5.5
Chicago, USA	Spring	6.9
Massachusetts Bay,USA	Summer	1.4
Tampa Bay, USA	Summer	0.6
Taichung, Taiwan	Urban	17.6
	Industrial	24.6
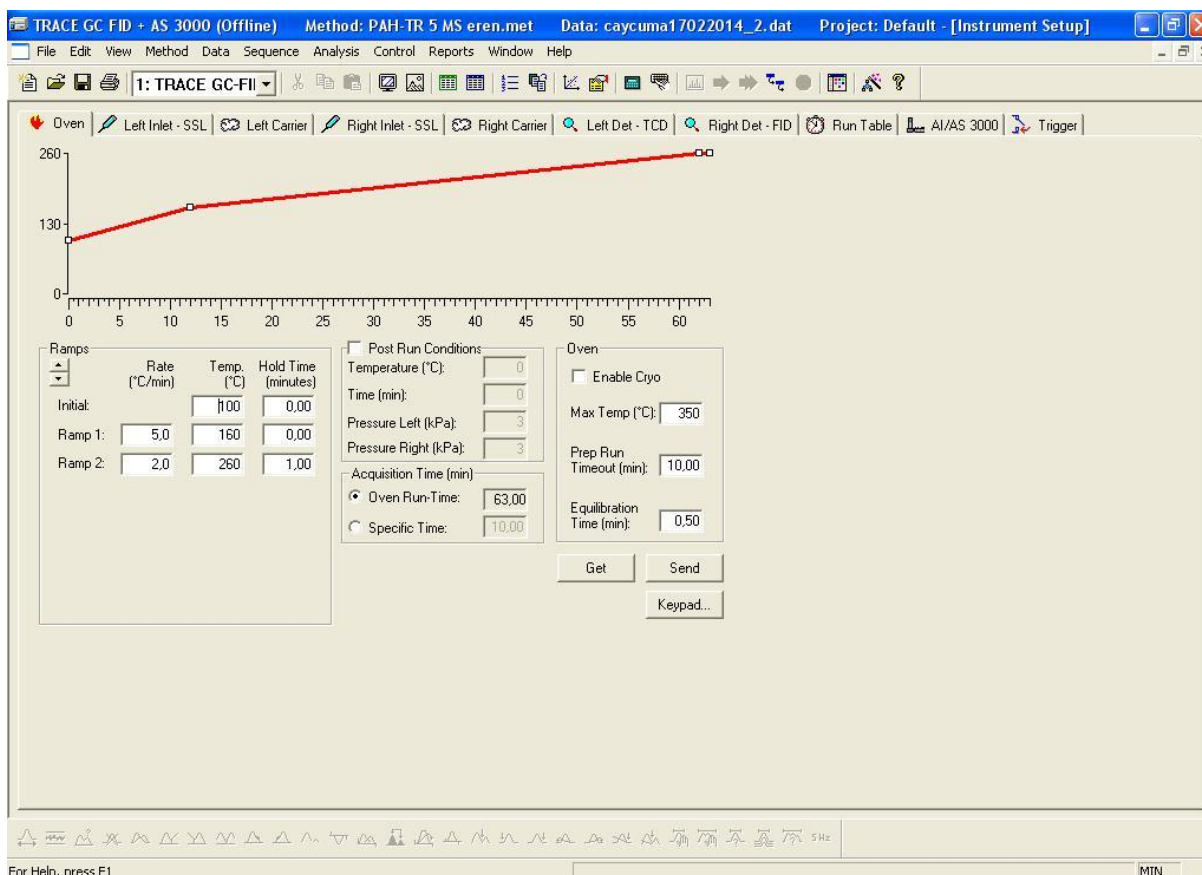
Figure 3. PAHs- GC method information-1
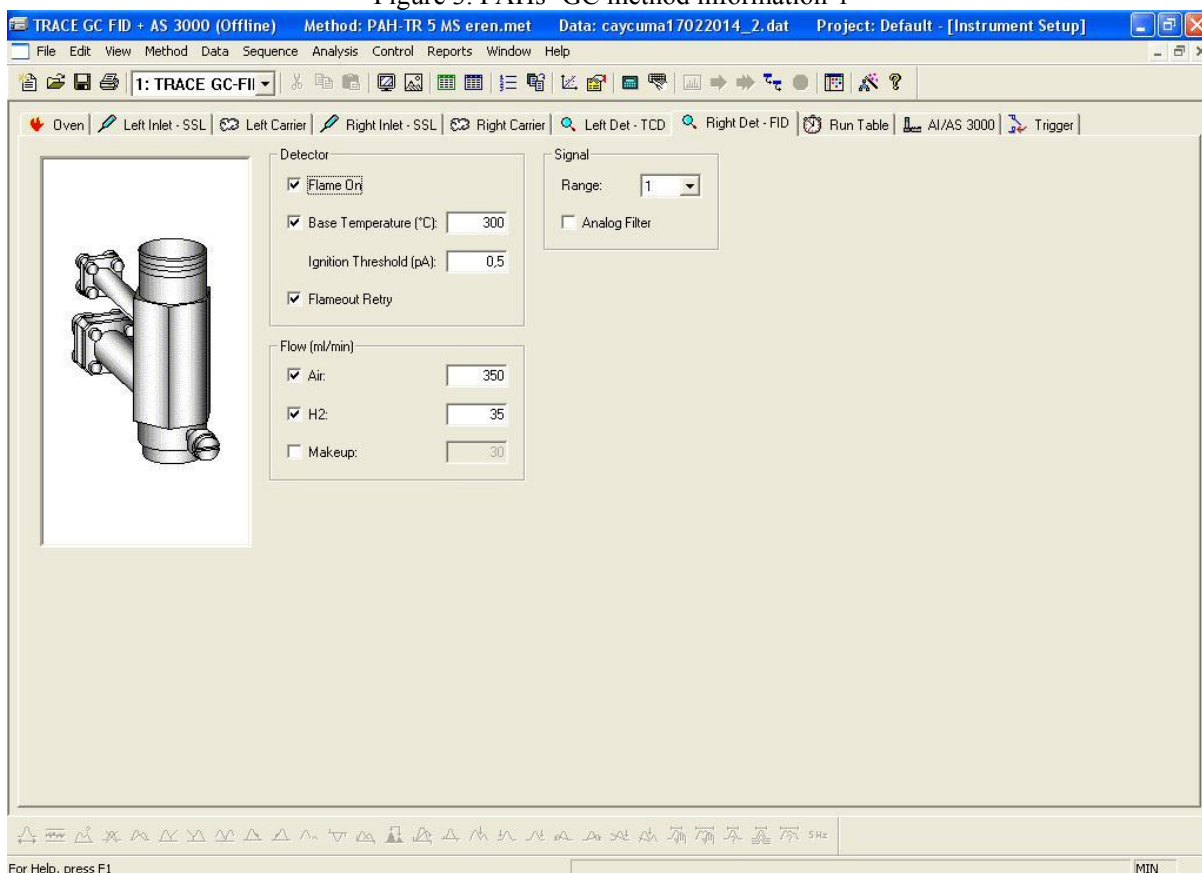
Figure 4. PAHs- GC method information-2
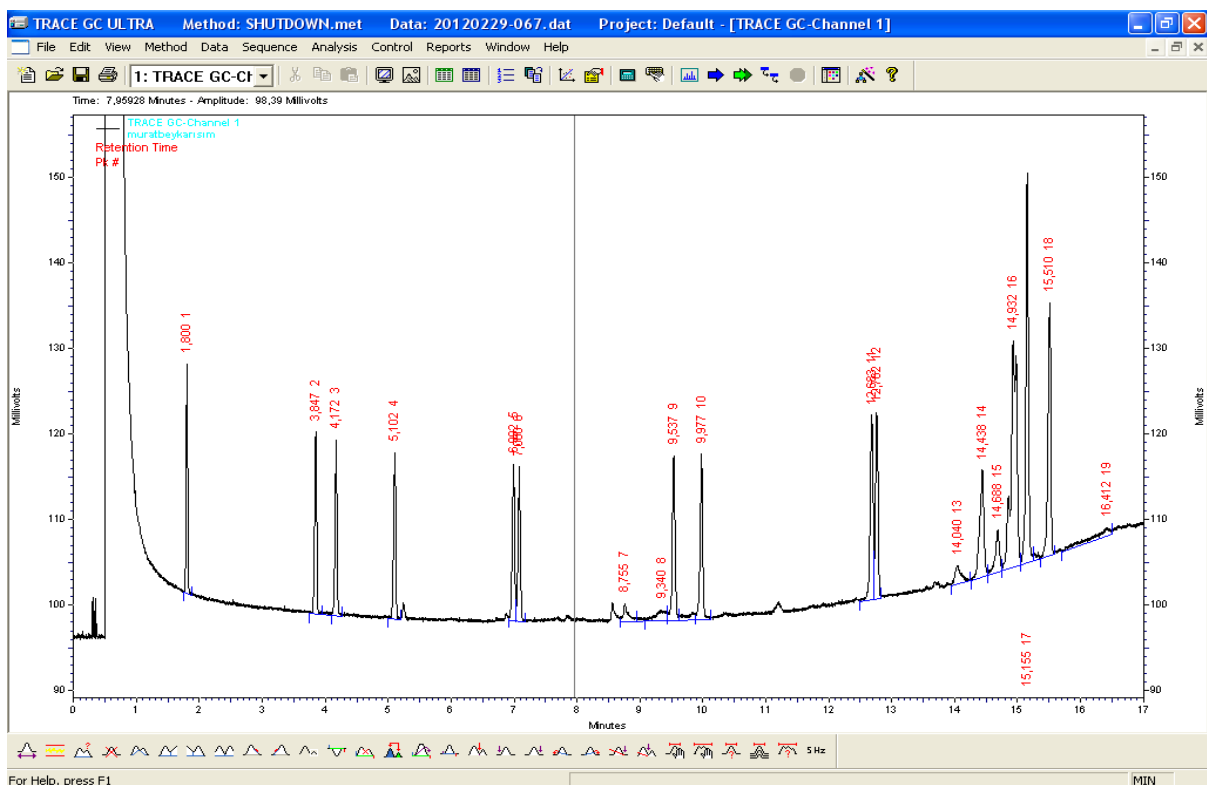
Figure 5. PAH Peaks
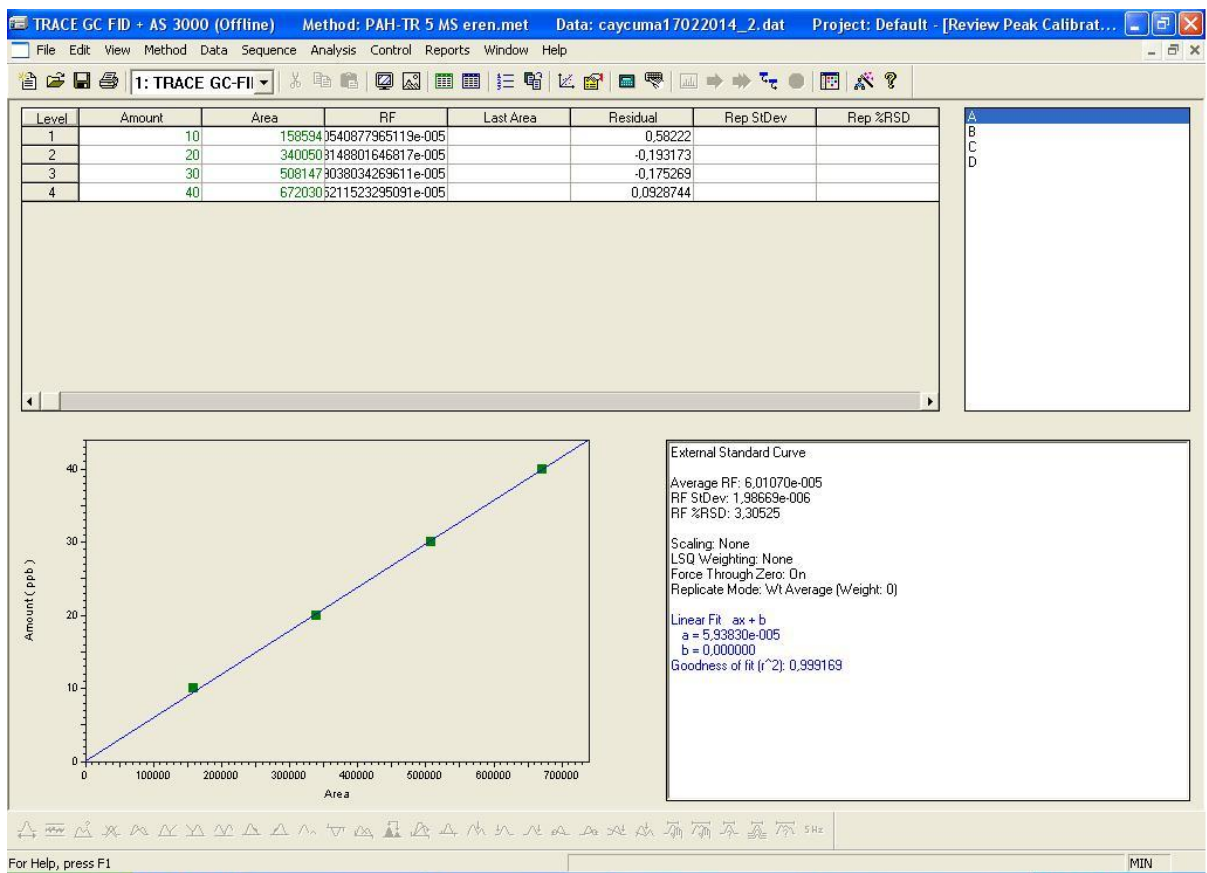
Figure 6. PAHs- GC method calibration curve

CONCLUSIONS

In previous study, particle associated PAHs through active air sampling has been measured in Zonguldak region at one point. Total concentration of PM10-associated PAHs were found as 492.4 ngm^{-3} in winter and 26.0 ngm^{-3}in summer times (Akyuz and Cabuk, 2009).

In this study, calibrations of PAHs were made in the first stage. In the second stage, dry deposition samplers will be used for measurement of PAHs deposition. With results of the projects, important data about PAHs will be obtained and sources of PAHs will be identified. We will have information about how PAH emissions disperse and deposits in Zonguldak region.

Potential exposures to PAHs may be assessed and results will help us to evaluate the degree of intake of PAHs into the human body.

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RESEARCHES ABOUT DOWNGRADED LANDS IMPROVEMENT BY SILVO-IMPROVED TREES AND SHRUBS CULTURE FROM BAIA MARE AREA

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Abstract

The purpose of this study is forestry ecological reconstruction on downgraded lands from Baia Mare area, Maramureş county. This land is unsuitable for forestry and other uses because of the downgraded land from surface erosion and also because the average slope of the land is 15 ᵍ. The technical solution of improvement includes land and soil preparation technology, afforestation formulas, afforestation technique, planting scheme, and also sustentation needed until canopy closure for every site class. To establish the necessary of seedlings was taken into account planting schemes and percentage of completion for every afforestation composition, as well echeloning the surfaces covered by the project. By establishing the value of proposed works were calculated the costs of basic operations composed by fencing, terminals construction and placement, guarding the perimeter and afforestation works pending final success.

Key words: ecological reconstruction, downgraded land, surface erosion, afforestation formulas

INTRODUCTION

It can be shown that the analyzed perimeter is classified as part of the land area characterized by strong to very strong erosion.

The basic reality in the field finds its justification in the way that the forest has been exploited, on one hand, and, on the other hand, in the maintenance of the land lacking of protective forest vegetation. The identified triggers are the following: precipitous slope correlated with the middle friable substrates; sunny exposition; relatively large lengths of slopes; large amount of precipitation; lack of vegetation within the perimeter; irrational exploitation of the land. (Ciortuz, I., 1981)

As a result of the cumulative action of all these factors, it has been noticed mainly the occurrence of soil erosion, namely gully erosion and especially superficial erosion, with profound negative effects on both production and protection potential of soil.

The onset as well as the intensification of soil erosion processes within the studied perimeter lead to the appearance of some negative consequences which affect the entire environment.

The erosion processes taking place within the area were the study was carried out are mainly caused by climate rich in precipitations which constitutes the vector that moves soil particles; plus the relatively precipitous slope which amplifies the effect of raindrops. These modifications determined by the change of both hydrological and soil aeration regime cause soil compaction, making it losing its structure and unable to maintain vegetation – the only natural element capable of ensuring soil stability.

Changes also occur at the level of soil and, respectively, vegetation, as well as at the microclimatic level for a number of climatic parameter are also affected: temperature, surface albedo, radiative capacity, etc. Also, another effect is visible from the aesthetic and social point of view, if taking into account the tourism potential of the area and the unpleasant appearance of the land as a result of the soil degradation processes.

The consequences of these torrential phenomena are more than negative for the environment, because all the mechanisms and

biological cycles that maintain the production potential, protection, aesthetic and social role of soil and vegetal cover are disrupted.

It can thus be said that there are sufficient reasons that justify the execution of engineering measures able to restore the land to its optimum operating conditions; these measures should be implemented as quickly as possible and accordingly with the actual real needs of the studied perimeter, also taking into account the fact that degradation processes are very dynamic, and nature does not have the means to stop them a rapid and safe manner. (Chiriţă, C., 1977)

The perimeter taken into study is directly influenced by the soil erosion processes, as it follows: soil erosion hazard (R) – medium; morphological slope (I) – 11-30% for basins and 21-60% for slopes; rainfall factor (P) – precipitations 945mm; soil texture (T) – light; vegetable factor (V) – pastures. Having in view the above mentioned characteristics, one can notice a predisposition to moderate erosion and a strong erosion hazard.

The soil texture is medium, soil thickness 25-75 cm, pavement < 10%, therefore soil erosion hazard is strong.

The *Fournie* index ($F_i = \sum_{i=1}^{12} \frac{p_i^2}{p}$) has a value equal to 90, and the *Bagnouls- Gaussen* index is below 50 (humide climat), so the climate erosivity is medium.

By correlating the soil erosion hazard with the climate erosivity and the medium slope of 33%, it results that the potential risk of erosion is strong and, as the land is incompletely covered with vegetation, the actual risk of erosion is also strong.

In conclusion, it is men's moral and social obligation to intervene promptly, by applying concise and effective measures in an attempt to restore the ecological balance within the improvement perimeter which was so severely disrupted by human activities.

MATERIALS AND METHODS

In order to take into account the multiple objectives pursued and the diversity of the existing situations in the improvement perimeter, the adoption of a complex set of works was required

Also, the adoption of this set of measures and improvement works is determined by the principle of full and sustainable land improvement (the second principle of Forest Improvement). The list of ameliorative complex assembly works is represented by: gathering stones and boulders; execution of simple terraces and / or supported terraces; belt planting system; brush head plug; works of retention or diversion upstream the detachment ravine; soil preparation works; fertilization works using topsoil and fertilizers; works of amending the acidic soils; afforestation works; security measures and fencing works. It is also necessary to adopt some ameliorative measures so as to stop the intensification and development of negative processes that manifest in the analyzed perimeter; these refer to both the land assembly within the improvement perimeter and the surrounding lands and consist of: restriction of use, exploitation rules, security measures and other measures. Restriction of use – the improved perimeter should not be exploited so that the degradation processes reactivate. Exploitation rules – it is forbidden to: operation of stands by clear cutting, grazing, tourism activities, etc. Security measures – it will apply in order to preserve the works made so as to achieve their goal. The improvement works are technical interventions which are executed exclusively on the improvement perimeter, and are divided into four categories: phyto-ameliorative works; site preparation and soil improvement; land development project; fencing works. Within the perimeter to be improved the effective area of woodland is 81,25 ha (96% of the perimeter). The role of the forest cultures is double - first of protection and subsequent, after reaching the equilibrium, of production, which occurs primarily on the soil, but also and the waters. Forest crops regulate leaking rainwater, stabilize, restore and recover the degraded land unsuitable for other uses.

As for their productive role, this is to obtain some products like: firewood, poles, resin, berries, etc., and later even wood for industrial uses (construction, pulp, etc.).

Social, climate and productive consequences of the improvement measures to be applied in perimeter are also taken into account.

By comparing the stationary conditions existing within the improvement perimeter with the ecological requirements of the species (the two factors underlying the choice of forest species for afforestation), for the improvement perimeter studied the following tree species were chosen: European black pine (*Pinus nigra Arn.*), Scots pine (*Pinus sylvestris L.*), maple (*Acer pseudoplatanus L.*), larch (*Larix decidua Mill.*), alder (*Alnus sp. L.*); shrub species will not be used, with the exception of the seadbucktorn (*Hippophaë rhamnoides L.*).

The extreme work conditions determine the elimination of sensitive or demanding species and only allow the installation of cultures composed of resistant and modest species, with high ecological amplitude; the heavier the conditions, the lower the number of species that can successfully be used.

The afforestation formula reveals the assortment and species' proportion and it is established depending on the intensity of degradation through erosion. Thus, on the moderately eroded land, one will introduce a high proportion of tree species, and, in extreme cases of very highly eroded and gully land, pine and, respectively, alder stands will be cultivated.

The planting method used for most of the surfaces is planting in normal pits of 30 x 30 x 30 cm. Within the ravine area the belt planting system is applied. The list quantities of the proposed works contains all the quantities of works proposed for execution in the improvement perimeter; for these works were mentioned the following: the specific code of the work, the unit of measure and the amount of work. The list serves for planning and evaluation of works, to determine the cost of the necessary work and labour (see table below).

For the proposed works to be executed to become operation as quickly as possible, the works started in 2004; they were carried out for 8 years and they were came to completion in 2011. Due to the large volume of work, was chosen to scheduling the deployment of forest cultures in the first two years: 2004, 2005.

The works were executed by direct labour by the Baia Mare OSM; the necessary workforce will be recruited from the nearby villages.

Table 1 Proposed works within the improvement perimeter

Category of work	Code of work	Name of work	UM	Quantity
1	*2*	*3*	*4*	*5*
A **Afforestation works**	A1	**Installation of forest cultures**	*1000 pieces*	**591,7**
	A2	**Completions of forest cultures**	*1000 pieces*	**177,16**
	A3	**Maintenance of forest cultures**	*Hectar*	**814,4**
B **Soil preparation and improvement works**	B1	**Preparation in patches**	*Aries*	**1408,79**
	B2	**Fertilization with topsoil**	*m³*	**3691,75**
	B3	**Fertilization with organic fertilizers**	*t*	**0250**
	B4	**Amending with limestone powder**	*t*	**277,5**
C **Territory management works**	C1	**Gathering stones and boulders**	*Stere m*	**735**
	C2	**Simple/ continuous terraces**	*m*	**222 000**
	C3	**Terraces with fences**	*m*	**40 781,25**
	C4	**Terrace with banquette**	*m*	**7343,75**
	C5	**Brush head plug**	*m²*	**1900**
D **Fence/ enclosure works**	D1	**Wire fences**	*m*	**3420**
	D2	**Perimetral quickset hedges**	*1000 pieces*	**17,784**

The necessary seedlings are taken from the Baia Mare O.S.M. nursery except alder, which will come from natural regeneration. The posts and stakes are ensured by Baia Mare O.S.M. as well, as a result of the cultural works performed within the forest district. The topsoil comes from borrow pits and the organic fertilizers from local farms. The stone designed for the terraces with banquettes comes entirely from the improvement perimeter. The other materials will be purchased from specialized

distributors (nails, wire, etc.) The workers will be organized into teams, each team comprising three workers. Within the perimeter, it will be build barracks for workers, housing materials, glaciers to protect seedlings, paths etc. The working site will be equipped with medical kits.

It will not be lost sight the safety issues of the working site and it will consist of making the necessary briefing before starting work.

RESULTS AND DISCUSSIONS

In the analyzed area, there were identified 12 soil classes and 22 types with numerous subtypes and soil units, which differ distinctly concerning their properties, productive capacity and measures to preserve and enhance fertility.

The main classes of soils in the studied area are: protisoils with 30,25% of the total surface, out of which: aluviosoils represent 29,5%, lithosoils are extended on 0,69%, regosois cover 0,06%. Cambisoils with 24,49% of the total surface, out of which: acid bown soils cover 18,2%, bown forest soils cover 6,29%. Luvisoils with 23,43% of the total surface, out of which: brown podzolic soils cover 16,41%, reddish brown forest soils cover 7,02%. Chernozemic soils with 6,34% of the total surface, out of which: phaeozems cover 5,58%, rendzines cover 0,47%, chernozemlike soils are extended on 0,28%, kastanoziomurile cover 0,01%. Andosoils with 5,99% of the surface, out of which: andosoils ocver 5,99%. Spodisoils with 5,92% of the surface, out of which: prepodzols cover 5,60%, podzols cover 0,32%. Also, on specific small areas there are antrisoils, histisoils, salsodisoils and umbrisoils.

The associations of plants that live and characterize the hilly area of Transylvania are ones of the most diverse: herbaceous vegetation: *Agrostis tenuis, Festuca rubra, Festuca pseudovina, Agropyron repens, Pirus piraster, Medicago falcata,Crisium arvense* etc.; forest-improving shrubs: *Crataegus monogyna, Ligustrum vulgare, Cornus sanguinea, Hippophae rhamnoides* etc.; medium and large forest trees: *Pinus silvestris, Pinus nigra, Fagus sylvatica, genul Quercus, Carpinus betulu*s etc.

The analysis of eroded land, in different degrees of intensity, shows the following situation: strong and excessive erosion which affects: Maramureş area - affected areas count a total of 77 395 ha, representing about 6% of the territory; the moderate or severe erosion affects 70 000 ha in the Mures county, 125 000 ha in Bistrita-Nasaud and Cluj etc.

Regarding the forest-improving shrubs and their culture on the degraded hilly area of Transylvania, one can mention that a culture of forest- improvement trees and shrubs is the best option that should be considered for an ecological restoration.

If referring to some several properties that recommends the of silvo-improved shrubs, one can say the following: common privet - *Ligustrum vulgare* – contributes at the forest ecosystems, degraded, in the course of degradation and even for the non-degraded ones, by improving the physical and chemical properties of soil. It also covers the soil, by reducing the risk of soil erosion processes. It is an unpretentious species, very resistant to frost, drought and pollution, with reduced claims for soil properties, covering even the rough, flooded or skeletal soils and supports well both direct sunlight and shading. Since no outstanding claims are demanded, as well as a consequence of the fact that is sprouts, sends out suckers, layers and propagates by shoot cuttings, the common privet knows a great ecological amplitude.

The red dogwood - *Cornus sanguinea* – gives good results on: moderate to highly eroded soils, moderate rain-denudated lands, land fugitive lands on intact soils sites, has good results in terms of improving the forest-productive qualities of the soil

The seadbucktorn - *Hippophae rhamnoides* - by its rapidly expanding capacity on large areas is a good solution for the majority of degraded hilly land of Transylvania. Its ability to live in symbiosis with nitrogen-fixing bacteria give this shrub a plus in terms of its importance to degraded lands. Valorification of seadbuckthorn can have a positive impact on the areas where it is implemented.

Depending on the identified topo-climate within the improvement perimeter and on the type and intensity of the degradation processes, one selected the species used for afforestation:

silvo-improved bushes *Cornus sanguinea*, *Ligustrum vulgare* and *Hyppophae rhammnoides* , and large forest trees: *Pinus nigra* and *Quercus petraea*, as main base species, *Acer platanoides*, *Fraxinus excelsior*, *Alnus glutinosa* as main mix species.

On slightly eroded soils, the afforestation formulas were 50Go 25 Pa 25Sâ, preparation of soil was made in patches of 60x80 cm, planting was made accordingly to the scheme 2,0x1,0 m, using seedling with naked roots, 5000 buc/ha, in holes of 30x30x30 cm.

On the weakly to moderately eroded soils(e1-e2), the afforestion formulas were 25Go 50 Pa 25Sâ, the preparation of soil was made in patches of 60x80 cm, planting was made after the scheme 2,0x1,0 m, using seedlings with naked roots, 5000 buc/ha, in holes of 30x30x30 cm.

On soils with precipitous slope the management was using made unsupported terraces arranged accordingly to the contour lines at 2,0m distance between them and 0,75m width, following the planting scheme 2,0mx1,0m, resulting a density of 5000 buc/ha.

On strong and very strong eroded soils (e2-e3), the afforestation formulas used were 50 Pin 25Pa(Fr) 25Sâ, or 50Pin 50Ct; in the case of 50Pin 50Ct formula, the forest management was made on the basis of terraces supported by fences, places on the contour line at a distance of 3,0m and 0,6-0,7 m width. Planting was made using seedlings with naked roots, in the case of supported terraces for the seadbucktorn, in belt system, between terraces (13300 buc/ha, schema 3,0m x 0,22m) or in normal holes of 30x30x30 cm (3300 buc/ha, schema 3,0m x1,0 m), (perimeter Tonciu, u.a. 83 A, D, H, L, R).

In the case of 50 Pin 25Pa 25Sâ formula, preparation of soil was made in patches of 60x80 cm, planting was made using the schema 2,0x1,0 m, using seedlings with naked roots, 5000 buc/ha, in holes of 30x30x30 cm.

On sliding soils, with slid mass low to moderate fragmented with humus horizon remained at surface, without water excess, the afforestation formula was 25Go 50 Pa(Fr) 25Sâ(Lc), preparation of soil was made in patches of 60x80 cm, planting was made by the accordingly to the schema 2,0x1,0 m, using seedlings with naked roots, 5000 buc/ha, in holes of 30x30x30 cm. On the sliding slope,

with mother-rock at day, the afforestation formula was 100Ct, being planted on belt system, by the schema 3,0m x 0,25 m, resulting a density of 13300 buc/ha.

The observations on the evolution of crops installed within the improvement perimeters were made in the perimeter of Coasta Mare, Teaca and Tonciu. As a result of the comments made regarding the maintenance of seedlings after a year or two after planting, it can be concluded the following: on weak to moderately eroded soils (degraded land station group 8), a very good maintenance on soil arranged on simple terraces, *Ligustrum vulgare* (92%), planted in patches in normal holes, *Cornus sanguinea* (75% on simple terraces, 89% in patches in normal holes.

Preparation of soil in simple terraces, where it is possible, influences positively the maintenance of seedlings. On strong eroded soils (degraded land station group 9), a very good maintenance registered *Cornus sanguinea* (90%-Teaca), good maintenance *Ligustrum vulgare* (67%) when preparing in patches and planting in normal holes by the schema 2,0 x 1,0, composition based on *Pinus nigra*, *Acer platanoides*, *Fraxinus excelsior* and *Cornus sanguinea* resulting the best records.

On strong an very strong eroded soils, a very good maintenance registered *Cornus sanguinea* (84% on strong eroded soils with preparation of soil in patches and planting in normal holes using the scheme 2,0 x 1,0m), very good maintenance *Hyppophae rhammnoides* (83% on very strong to excessive eroded soils, when planting in belt system using the scheme 3,0 x 0,25m).

On sliding soils, with slid mass low to moderate fragmented (degraded land station group 54), the maintenance was: *Ligustrum vulgare* 87%, planted in patches in normal holes, scheme 2,0x 1,0; *Cornus sanguinea* 83%, planted in patches in normal holes, scheme 2,0 x 1,0.

On sliding soils, with slid mass strong to very strong fragmented (degraded land station group 55), the maintenance was very good for the seadbucktorn -88%.

After analyzing the results it appears that, the compositions based on large forest species in combination with shrubs silvo-improved shrubs *Hyppophae rhamnoides*, *Cornus sanguinea*

and *Ligustrum vulgare*, suite best to stationary conditions of the stationary group of degraded land 54 of the studied area. Within the degraded land station group 8, only one experimental lot was set-up, where seedlings of *Quercus petraea, Fraxinus excelsior* and *Cornus sanguinea* were used.

Regarding the maintenance of seedlings at the end of the vegetation season 2009, although the highest values of maintaining the seedlings were obtained for the variants mobilized (84%), as compared to 79% in the control, a clear conclusion cannot be expressed if soil mobilization significantly influences the maintenance of seedlings. Experimental area will be further pursued.

Within the degraded land station group 11, 4 experimental lots were set-up, the species used being *Pinus nigra, Fraxinus excelsior* and *Cornus sanguinea.*

CONCLUSIONS

In conclusion, in the case of the soils by low to moderate erosion, the land management on simple terraces and planting on terraces leads to better results than planting in patches. On strong eroded soils, the *Cornus sanguinea* seedlings, planted in patches, in normal holes, using the scheme 2,0 x1,0, maintained the best. On very strong and excessive eroded soils, the preparation of land on terraces supported by fences and planting seadbucktorn in bet system between terraces leaded to good results.

On sliding soils, the *Ligustrum vulgare* seedlings recorded the best maintenance. Mulching on terrace or in patches using cardboard, straw, litter, has a positive and significant influence on seedlings' maintenance.

The use of compost mixed with local soil to plant seedlings, in the context of lack of rainfall in the period after planting the seedlings, have a negative influence on seedlings' maintenance.

Nitrogen fertilization positively influences vegetation state of seedlings. But, it cannot be confirmed yet whether the mobilization of soil and nitrogen fertilization on the patches really influences the maintenance of the planted seedlings; further experiments must be pursued. The most recommended species of silvo-improved shrubs for the Transylvanian hilly area are represented by: *Cornus sanguinea, Ligustrum vulgare, Hippophae rhamnoides,* due to the fact that they registered a very good rooting percentage, although the planting was made using naked roots, which proves their adaptability to rough soil conditions.

It is to be noted that restoring the downgraded land in this area takes time and can be achieved only by combining both species of shrubs and forest trees, as well as by grassing with species that cover the soil.

The ecological reconstruction process and procedures vary from case to case, but they are necessary to ensure the restriction of phenomena adversely affecting soil and their reintegration into forestry and agricultural circuits at optimal levels of production

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THE INFLUENCE OF SLAG AND ASH DEPOSIT USED BY DROBETA - TURNU SEVERIN POWER PLANT CONCERNING GROUNDWATER IN THE AREA

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Abstract

The evacuation of slag and ash resulting from coal combustion in Drobeta-Turnu Severin Power Plant is made hydro-mechanical (pumped) in a deposit located near Halanga locality from county Mehedinti. This work shows the hydraulic circuit inside of Drobeta-Turnu Severin Power Plant and the deposit of slag and ash from Halanga. The deposit impact is analyzed concerning groundwater in the area. Also it is presented the waste disposal technology after the date of 31.12.2015, possibly to be used, in order to comply with the European Union Directive 1993/31/CE.

Key words: coal combustion, groundwater, Power Plant, slag and ash.

INTRODUCTION

This work shows the hydraulic circuit inside of Drobeta-Turnu Severin Power Plant and the deposit of slag and ash from Halanga. The deposit impact is analyzed concerning groundwater in the area.

During the process of joining to the European Union, Romania has completed negotiations for "Chapter 14 - Energy" and "Chapter 22 - Environment".

For this purpose Romania had to implement EU directives on waste disposal, concerning the limitation of emissions of certain pollutants into the air from large combustion plants and directive for integrated pollution prevention and control.

The Romanian Government's plan to implement Directive 1999/31/EC on the landfill of waste (transposed by HG 349/2005) and Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air, has provided a transition period for comply between 2008 and 2013, which includes all Plants Plants which are using coal (Council Directive 1999/31/CE of 26 April 1999; Directive 2001/80/EC).

As a result of environmental agreements achieved and approvals of the water management, some ash and slag deposits may operate using classical solution (dilution 1/8 to 1/10, slag and ash / water) until 31.12.2015. After this date these deposits will have to be closed and Power Plants (electrical and thermal) will have to operate on gas or to adopt another solution using dense slurry technology (slag and ash / water = 1/1).

The electrical energy in Romania is created by Power Plants (they use different resources, such as, coal, marsh gas, oil fuel etc.), hydroelectrical Power Plants, Nuclear Plant and

Plants that used renewable energies (wind, sun etc).

Currently, the national power system installed capacity is about 18.651 MW, of which:

- 12.664 MW - 67,9% in Power Plants
- 5.278 MW - 28,3% hydroelectrical Power Plants
- 709 MW - 3,8% in Nuclear Plant from Cernavoda.

From 12,664 MW of power in power plants are installed:

- 6.546 MW - power plants using coal
- 6.118 MW - power plants using oil fuel.

According to estimates, at least until 2020, coal will remain the main energy resource of the country, and consumption will be about 30 million tonnes of energy coal annually. Coal burned in power plants comes from domestic production and has the following structure: 90% lignite (poor quality coal) and 10% pit coal.

Because coal used in power plants is of lower quality (90% poor quality coal), the amount of slag and ash resulting from burning is about 28-35 % of the coal burned.

Since it is estimated a consumption of approximately 30 million tons / year, the quantity of slag and ash resulted is about 10 million tons / year. About 95% of the slag and ash is kept in industrial waste storages and the remaining 5% is used in different parts of the economy. The utilization of slag and ash in the economy is reduced due to poor economic concerns and mediocre quality of slag and ash resulted from power plants.

In Romania there are currently 27 ash and slag deposits at 23 power plants in operation. These deposits heights up to 65 m, occupies the land up to 160 ha and contain up to 35 million cubic meters of slag and ash.

Of the 27 available locations to 14 of them were produced different faults and incidents, which consisted of:

- hidroamestec spill over the dam's crest;
- malfunction of drainage system;
- malfunction in the collection and recycling of water.

Because of these accidents and incidents occurred disposals of slopes, dam breaks with gaps of up to 20 m tall, with discharge of tens of thousands of tons of ash and slag, increasing the groundwater in these areas, affecting human settlements and crops, etc..

The transportation between power plants and waste industrial storage is made through hydraulic pumping. According to current technology slag and ash is mixed with water in a ratio of 1/8 to 1/10 (slag + ash / water).

In order to create the storage for slag and ash, the base of the dams must be made first out of local materials. When the storage become almost full the extra elevation dams are created from slag and ash already deposited. Those dams are made with excavators, bulldozers and compactors (Figure 1).

Figure 1. Extending the slag and ash deposit

MATERIALS AND METHODS

The Power Plant from Drobeta-Turnu Severin was used for first time in 1985. It is now equipped with:
- 6 steam boilers of 420 t/h
- 4 turbo aggregates of 50 MW
- 1 turbogenerator of 25 MW
- 1 turbogenerator of 22 MW, powered by coal.

The Power Plant from Drobeta-Turnu Severin is located aproximatly 6 km from Drobeta-Turnu Severin, and the ash and slag deposit is located to about 1.50 km from the power plant, on Trestelnic valley around the Halânga village.

In order to reach the destination from Drobeta-Turnu Severin you must follow the DN 67 which connect Drobeta-Turnu Severin and Târgu-Jiu, and from the power plant to the slag and ash deposit you have to follow a road used in exploitation of the deposit (Figure 2).

The location of the slag and ash deposit is a valley with two compartments that was created through the barring of the Trestelnic creek. The Trestelnic creek is located at aproximatly 5 km upstream from the interconnection with the Danube River. The base of dam was created from local materials, it is 5,5 m tall, the slopes upstream and downstream are 1:3. Through the achievement of the base dam, Trestelnic creek is blocked at aproximatly 2,5 km downstream from the springs that are a 2 km away.

Once filled with slag and ash the deposit was raised with 7 more dams, made with material from the deposit in the "upstream" system. These dams have a height of 5,50 m, upstream and downstream embankment slopes are 1:3.

The Trestelnic creek is 5 km long from the springs to connecting of the Topolniţa River, and the area of hydrographic basin is 4,38 km². River flow is generally reduced, with large fluctuations during the year depending on the amount of rainfall and has a rapid concentration of runoff due to high slope of the river sides.

The valley represent asymmetrical slopes, the the right slope being more steep. Highs increased from 110,0 to 115,0 m in the valley to 250,0 – 300,0 m towards the montains slope. In the area provided for the dams, the valley is narrow and steep, offering morphological conditions that are favored for damming.

Downstream Tresteln creek crosses the superior terrace of Topolniţa River and creates the south limit of the power plant, the section where the valley was regulated.

In the area provided for the storage, the land contain pastures whith rare clusters of forest.

In this region, along the water, canvas groundwater was discovered, quartered in layers of quaternary gravel and boulders which is powered by the waters infiltrated in the mountains slopes. In the power plants vicinity, on the Danube terrace the underground water that was discovered was in its natural conditions at aproximatly 6 – 12 m. The base rock from around the slag and ash storage has a rich content of clay and the marble has been water-proofed.

In the mountains slopes were not discovered aquiferous layers. In these conditions the contribution of groundwater is insignificant, so store operation is not affected.

Industrial water supply is made for both the Chemical Drobeta-Turnu Severin Plant and for Drobeta-Turnu Severin Power Plant.

The water is carried from the Danube River, upstream from Drobeta-Turnu Severin, in Schela Cladovei village, through the pumping station (caisson type). The water flow capture from the Danube is around 4.812 m³/h, which is transported through a pipe with 1.000 mm diameter, on a 10 km distance to the Industrial Water Treatment Plant, near Halânga. A part of this flow is sent towards the Industrial Water Treatment Plant on Halânga (Q= 3.812 m³/h), and the remaining (Q= 1.000 m³/h) towards the mixing tank of slag and ash from Drobeta-Turnu Severin Power Plant. The water flow that passes through the Industrial Water Treatment Plantfrom Halânga is dispersed towards Chimical Treatment Station (Q= 2.888 m³/h) where the softening and demineralization process occurs and a 924 m³/h flow towards different departments used inside of the Power Plant (cooling towers, water storage tanks for fire departments, etc.). (Figure 3).

Figure 2. General layout.
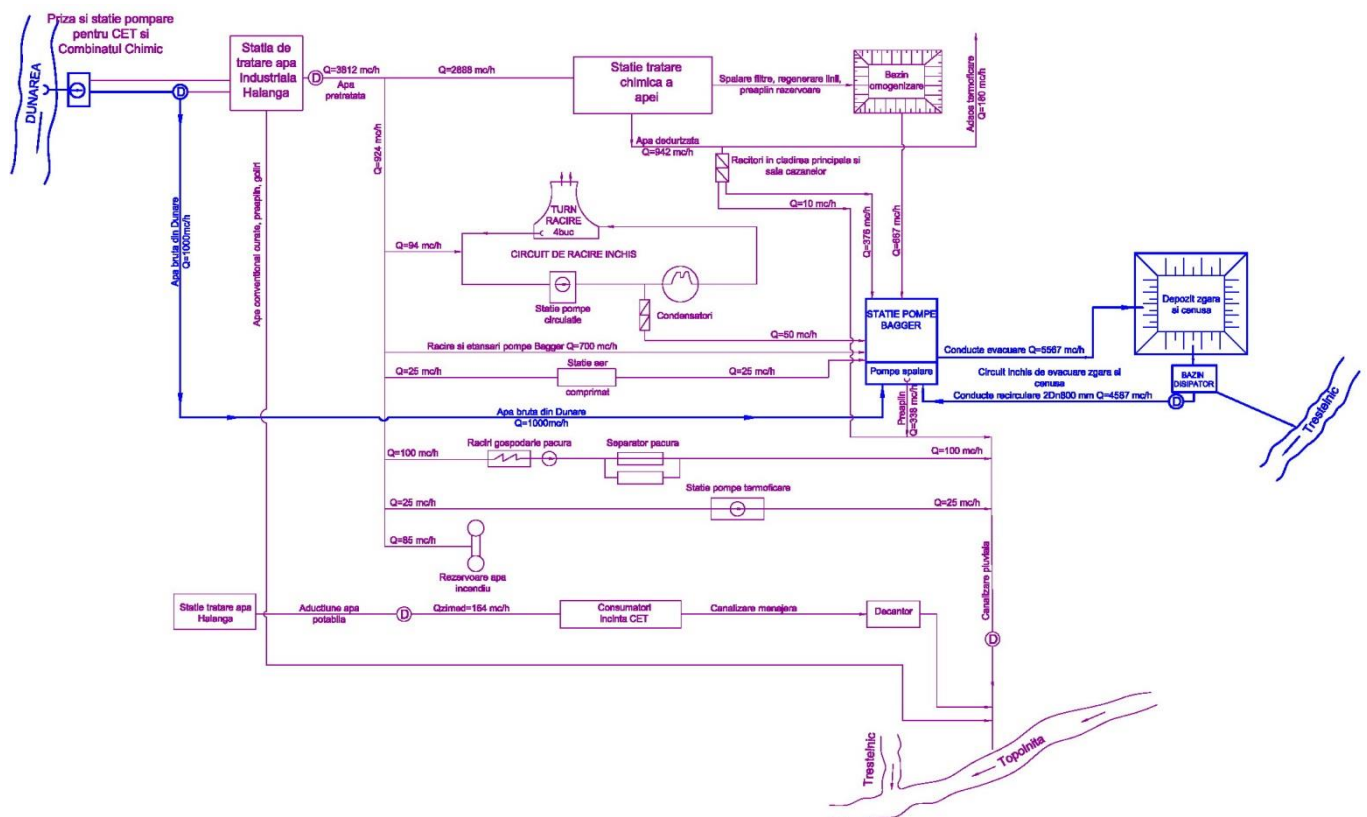
Figure 3. Hydraulic circuit

COMPARTMENT 1

DIG DE BAZA

Spre CET
DROBETA TR. SEVERIN
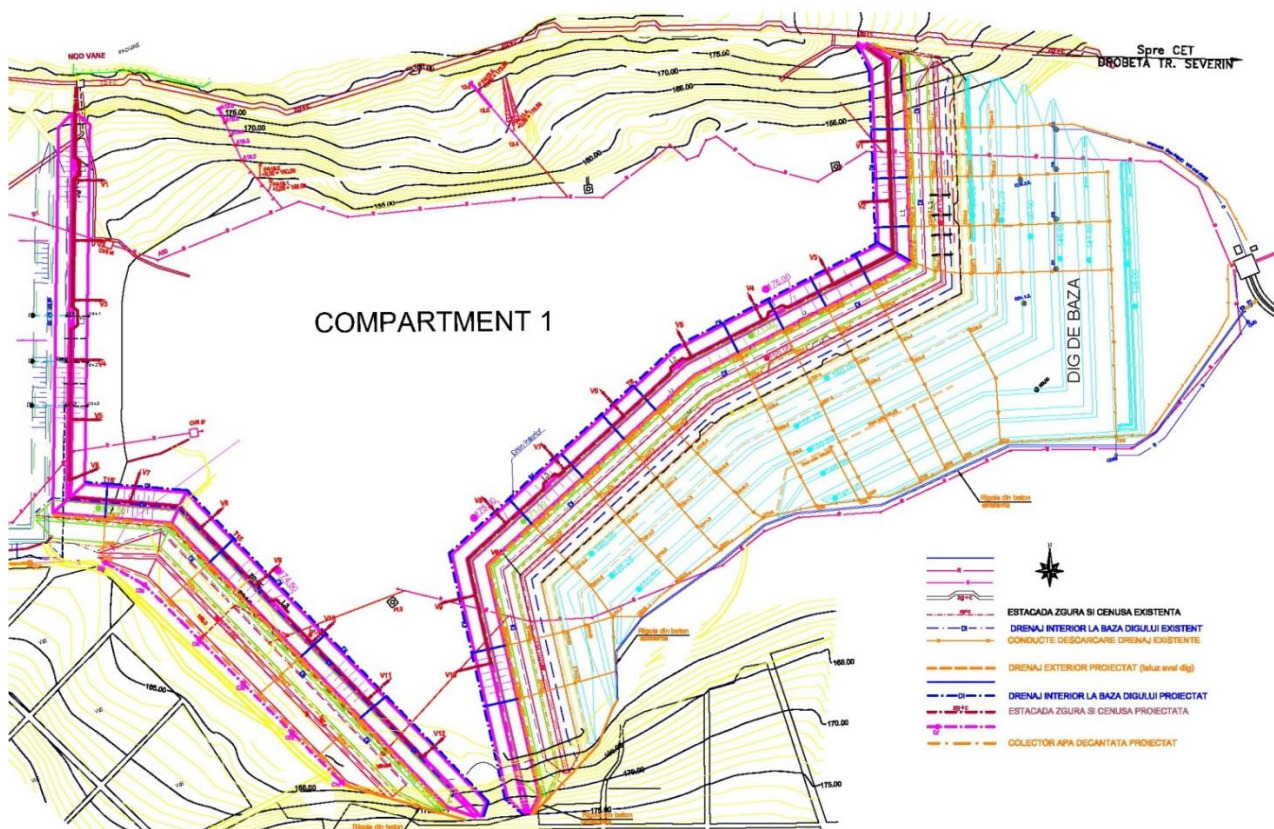
Figure 4. Overview of the deposit

The left over slag from the 6 steam boilers is crushed and then mixed with the ash from electro filters and with water in a mixing tank. The mixed percentage is 1:10 (slag and ash/water). Through pumping the mix is carried through a pipe that has a 400 mm diameter to the slag and ash deposit.

From the transfer pipes the mix reaches the distribution tubes (D= 400 mm) inside of the deposit. There is one distribution pipe in each compartment and extends over three sides of the compartment (Figure 4).

From the distribution pipes, the mix reaches the deposit using discharge pipes (D= 250 mm) provided with valves (Figure 5).

A couple of those pipes are always open in a aleatory way in order to achieve uniform filling of the compartments.

A part of the decanted water from the deposit is evacuated in the exterior through wells and spillway collections and the other part through the interior and exterior drainage systems.

The water from the deposit, that originated from slag and ash mixture, the water drained from the Trestelnic valley to the storage area and the one from precipitations is ejected onto the exterior of the storage through a collection

of spillways and wells (3 pieces in each compartment) and a drainage system. Through the evacuation system of the water from the storage, the discharge over the top part of the dams is avoided and also their stability is ensured.

Figure 5. Discharge pipe

A part of the water from the deposit is collected through wells and ejected onto the exterior through the pipes that pass under the dam. The spillway collection are made out of a prefabricated reinforced concrete (D= 1.000 mm, h=0,15 m). These rings allow to rise the

wells with increasing amount of slag and ash deposited and also raising the water level in the deposit. The exhaust pipes of the water collected in the collection wells are made of steel (D= 700 mm).

The interior drainage of the deposit is made at the upstream foot of the embankment on all its length. The water is collected through PVC pipes with 110 mm diameter, provided with gaps of 0,5x10,0 cm. These drains discharge from place to place in the concrete manholes (D= 1.000 mm), and from here, through PVC pipes with 150 mm diameter, without gaps, these pipes cross through the dam and the water is ejected in exterior drainage. The distance between the evacuation tubes is approximately 35 m. The exterior drainage is comprised out of concrete manholes (D= 1.000 mm), and corrugated pipes with 110 mm diameter located downstream at the bottom of the dams. The drainage pipes are placed in the trenches with 0,85 m depth at the interior drainage and 0,70 m at the exterior drainage. The drain filter is made out of geosynthetic filter material, the drain material (stone 30-70 mm) and ballast or gravel protection of 0,2-70 mm. The execution of the interior drain and the evacuation pipes is made before the start of the over height dam, and the exterior drainage after the execution of the new dam (Figure 6).

The water collected in the manholes executed on the exterior part of each dam, water collected by the drainage system inside and outside the dams, is discharged through pipes having 150 mm diameter to the perimetral channel located at the base of the dam.

The water evacuated through the interior and exterior drainage system of these dams with the water from the collection wells is directed towards the slag and ash chamber. In this way, it is recycled in the hydro mechanincal transport system.

(Project for extending the slag and ash deposit from Drobeta-Turnu Severin).
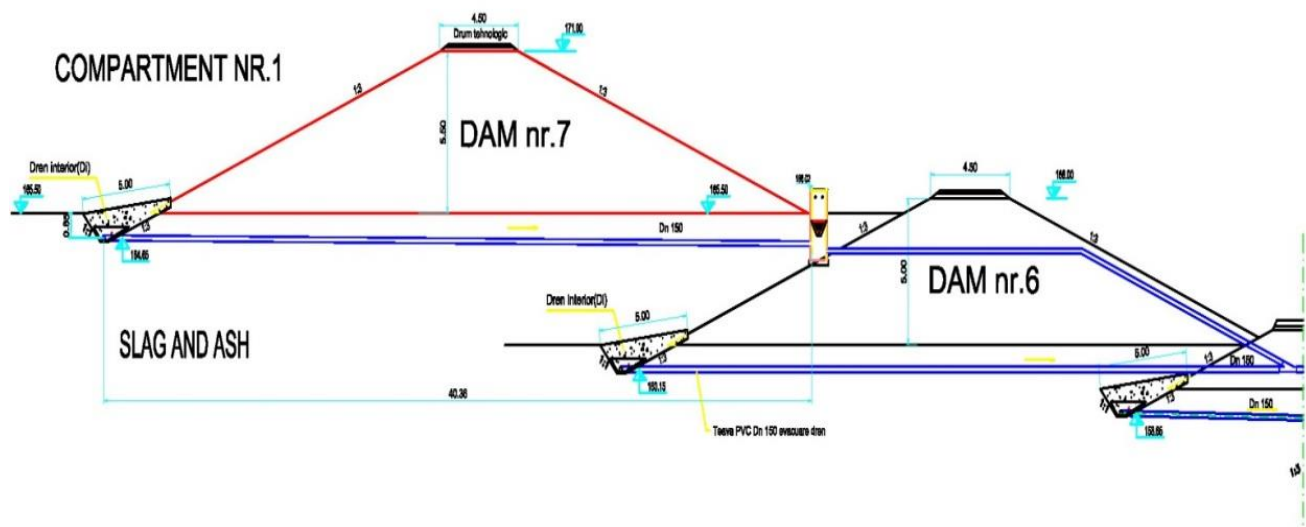
Figure 6. Dam number 6 and number 7. Cross section.

RESULTS AND DISCUSSIONS

The waste of slag and ash from the deposit have the following composition: ash (70% - 90%), slag and unrecoverable waste (10% - 30%). Physical, chemical and mineralogical properties of the ash varies based on the type of coals burned, technology and burning installations.

The ash from the Drobeta-Turnu Severin deposit has a sandy look, dark gray color (almost black) and contains between 3% and 5% coal. Mineralogical analysis of the ash reveals uncemented structures, weakly compacted with iron, quartz, feldspars, oxides, and mineral granules. Two types of slag and ash were determined:

- A type (rough), with 75% -85 % sand, 10% clay and 5% dust;
- B type (medium and fine), with 50% sand, 6% clay and 44% dust.

The physic-mechanical characteristics of the ash from the deposit, which is important for deposit's stability are: the friction interior angle

$\alpha = 30^0$, cohesion C = 0-40 Kpa, densities γ = 1,10-1,25 to/m^3, permeability k = 10^{-3}-10^{-5} cm/s. The chemical analysis of the ash proved the identification of free oxides with the silicon, iron, aluminum and calcium accent (Table 1). Those have a positive influence over the cohesion of the particles. Others like magnesium, potassium and sodium oxides have negative effects because they favor some oxidation or expansion phenomena. In time the filterability coefficient will become smaller. The chemical composition of the ash indicates a small affinity for water, reducing the retention of the water in deposit. (Geological, geotechnical and hydrogeological study).

Table 1. The chemical composition of ash from Drobeta-Turnu Severin Power Plant.

Concentration (%)	SiO_2	FeO_3	Al_2O_3	CaO	MgO	K_2O	Na_2O
Minimum	50,12	9,85	25,23	4,82	1,05	0,95	1,21
Average	52,65	10,65	26,37	5,01	1,31	1,01	1,41
Maximum	58,07	11,72	28,23	5,17	1,84	1,16	1,57

The slag and ash that results from the burning of coal is transported in mixture with the water from Danube River, in deposit where the decantation process of the solid particles occurs. The mixed result has alkaline character (pH = 8,5-8,8) and contains: suspensions (15-160 mg/l), fixed residue (1.200-1.300 mg/l), chlorides (50-75 mg/l), sulfates (700-900 mg/l), Na^+ (30 mg/l), Mg^{2+} (50 mg/l), Ca^{2+} (250 mg/l). The mineralization degree of the mixture is due to the soluble character of the salts (chlorides, sulfates) from ash.

The results of the chymical analysis of decanted water, the water collected through the drainage network, the mixture and the water from Trestelnic creek are represented in the Table 2.

Table 2. Water features: decanted, from drainage, mixt water, and from Trestelnic creek.

Indicators	UM	Water				NTPA001/2004
		decanted	drainage	mixt	Trestelnic	
pH		8,2	8,0	7,6	7,85	6,5-8,5
Suspensions	mg/l	-	-	-	197	35,0-60,0
Fixed rezidue	mg/l	2.800	1.283	860	529	2.000
Chlorides	mg/l	190	89	36	160	500
Sulfates	mg/l	1.452	574	462	122	600
Nitrite	mg/l	0,5	0,5	0,2	0,40	1,0

The waters from the slag and ash storage from Drobeta - Turnu Severin Power Plant have alkcaline characteristics, a high degree of mineralization and high concentration of sulfates and chloride. Because of those characteristics the accidental evacuation of the collected water into the Trestelnic creek will produce pollution.

The evaluation of the undergrown water quality can be realized through a sample out of 5 drillings executed downstream from the deposit. Groundwater level in deposit area is between 6 and 12 m beneath the ground level. In this paper we present the results of the undergrown water quality between 2009-2012. The groundwater quality parameters (registered after the quarterly physico-chemical analysis done between 2009-2012), were compared with the limited values admited in Law 458/2002 – The drinking water law (Table 3).

Table 3. The quality of groundwater near Drobeta-Turnu Severin slag and ash deposit.

Indicators	UM	Value			Law 458/2002
		minimum	average	maximum	
pH		6,5	7,2	9	6,5-9,5
SO_4^{2+}	mg/l	25,0	188	240	250
Cl^-	mg/l	3,2	43,1	316	250
Mg^{2+}	mg/l	0,2	24,0	152	
CCO-Cr	mg/l	9,1	41,9	72	
CCO-Mn	mg/l	6,0	14,8	117	
Electrical conductivity	μs/cm	170	1100	2147	2500 μs /cm
Fixed rezidue	mg/l	160	909	3690	

CONCLUSIONS

The burning of poor quality coals in the electrothermal plants from Romania has resulted in a large quantity of slag and ash. The transport of these residues (mixed in percentage of 1/10 ash+slag/water) from the plants to the storage units of slag and ash needs a large quantity of water. The collected and ejected water from the storage is recycled.

The reduction of the quantity of water used for the transport can be achieved by using the dense slurry technology (mixed in a percentage of 1/1 slag+ash/water). As a result of environmental agreements achieved and approvals of the water management, some ash and slag deposits may operate using classical solution (dilution 1/8 to 1/10, slag and ash / water) until 31.12.2015.

The location of the slag and ash deposit from Drobeta-Turnu Severin is in an area that has a hard pemeable ground. With a sufficient working dam and a good drainage system, small anounts of water infiltrates from the deposit in the groundwater. Based on this fact, the rise of the groundwater is not recorded.

The infiltration of polluting substances in the water from the deposit is reduced and does not affect in any important way the quality of the groundwater from this area.

It is best to monitor the evolution of the level and quality of the groundwater fom this area.

ACKNOWLEDGEMENTS

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Council Directive 1999/31/CE of 26 April 1999 on the landfill of waste.

Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants.

Geological, geotechnical and hydrogeological study made for the slag and ash deposit placed on Trestelnic valley corresponding to DROBETA-TURNU SEVERIN Power Plant.

Law 458/2002 – The drinking water law, completed with law 311/2004.

NTPA001/2002 - setting limits on pollutants charging industrial and municipal wastewater witch are discharging into natural receivers.

Project for extending the slag and ash deposit from DROBETA-TURNU SEVERIN. Stage II. Compartment number I. Dam no.7 to 171,00 m.

ECOLOGICAL ASSESSMENT OF THE LAKE MIRESEI CAMPINA

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Abstract

The aim of this writing is to identify the water quality through physico- chemical and biological indicators. Considering this the water state and quality class of the agrement lake " Miresei" had been analyzed from 2012 to 2013. The investigation had been based on the quantitative and qualitative methods of the phytoplankton, zooplankton and phytobenthos. The main indicators of this study had been the following: the physico- chemical indicators (the temperature, pH, O2, CBO5, NH4, NO3, NO2, orthophosphates, P and N) and the biological indicators represented by the plankton and phytobentos saprobity index. The writing had been made in the Faculty of Land Reclamation and Environmental Engineering laboratory. The ecological analyses results, led in June 2012, showed that the lake was strongly eutrophic, and as a result the water belonged to the fourth quality class. After the ecological reconstruction from the autumn of 2013 the water quality improved significantly. The physico- chemical and biological analyses made in 2013, placed the lake water in the second quality class.

Keywords: surface water, eutrophycation, plankton, ecological statement.

INTRODUCTION

Inland water bodies was considered important ecological and sociological zones. (El-Masri si Rahman, 2003). The lake Miresei has been in a continuous process of eutrophycation.

According to Brooks et al. (2003) water qualiy standard refers to the physical, chemical, or biological characteristics of water in relation to a specific one. Thus, it was noted that poor water quality may be harmful to the ecosystem and aquatic organisms. (Gozlan et al., 2006; Miller et al., 2002, 2011; Weitz and Wilhelm, 2012).

Chlorophyll-a concentration is a key indicator of water quality. (Cheng et al., 2013). Chlorophyll a is the most common of the other types of chlorophyll that is found in photosynthetic organisms such as algae and plants.

Selection of quality indicators directly affect water quality assessment results. (Luo HJ and al., 2002).

According to Icaga (2007) not all parameters of the water have been included in a single class of quality. For evaluation of water quality were identified and physico-chemical parameters was observed if they are in accordance with accepted standards of law. In addition, it was necessary to identify and monitoring the water bodies. The primary objective was to determine the status of water quality of the Miresei lake (also called The Church).

Eutrophycation of lake has been a strong increase in summer because algae appeared overdevelopment.

Further, in eutrophication, phosphorus and nitrogen are principal indicators. (Ruley and et al.,2004).

In Romania, water must reach a condition of ecological (physical and biological) to protect human health, water resources, natural ecosystems and biodiversity.
(Water Framework Directive).

Quality status of water bodies in Romania was analyzed according to Norm 161/2006 by which it was achieved classification of ecological and chemical surface water.

MATERIALS AND METHODS

The lake is situated in the north-central part of Campina town.

Currently, is a source of recreation and relaxation for inhibators. Therefore, it's a agreement lake. In order to assess the following methods were applied ecological research synthesis and analysis method (documentation in order to obtain basic data), field observation method (research and field trips to analyzing samples) and the comparative method (needed to assess the water quality of the lake). Water samples were collected from two points of sampling: of the depth 0.5 m and from the surface.

Water samples collection were made in 2012-2013 in three different months (July 2012 the growth of phytoplankton, october 2012 the mineralization of organic matter and in Aprilie 2013 the prevernal period.

Water samples were kept in glass well washed with distilled water and dried. These were kept at 4 ° C both during transport and until their analysis.

Table 1. Presentation of physico-chemical indicators that were determined state water quality of the Miresei Lake. Units and standard methods of determination.

Indicators physico-chemical	Units	Determination methods
Temperature	°C	Thermometrical
pH	-	Electrochemical
dissolved O_2	mg O_2 /l	Titrimetric Method (Winkler)
BOD$_5$/ CBO$_5$	mg O_2 /l	Titrimetric Method (Winkler)
Ammonium	mg N/l	Spectrofometric
NO_2	mg N/l	Spectrofotometric
NO_3	mg N/l	Spectrofotometric
Total Nitrogen	mg N/l	Volumeric Method Kjeldahl
Total phosphor	mg P/l	Spectrofometric with molibdat of potassium
Orthophosphate	mg P/l	Spectrofometric with molibdat of potassium
Chlorophyll a	µ g/l	Extraction of chlorophyll pigments

As shown in Table 1. quality indicators physico-chemical were based on standard assay methods.

From the physico-chemical point were determined 11 important indicators in determining water quality study: temperature, pH, dissolved O_2, BOD$_5$, NH$_4$, NO$_2$-, NO$_3$-, total nitrogen, total phosphorus, soluble orthophosphate and chlorophyll a.

The temperature and pH of the water samples were analyzed at mercury thermometer and the pH with the electrochemical method. The pH was measured with a portable pHmeter, a glass electrode and a calomel electrode. The other indicators in Table 1 were analyzed in the laboratory. From Table 1, it was observed that dissolved O_2 was determined by the most common methods: Titrimetric (Winckler).

BOD$_5$ analysis was determined by the titrimetric method Winckler, but diluted and undiluted water sample.

NH$_4$, NO$_2$-, NO$_3$-, P total and orthophosphate were measured spectrophotometrically and total N was determined by Kjeldahl volumetric method. Method of chlorophyll a was extracting chlorophyll pigments with organic solvents.

Table 2. Identifying biological analyzes were necessary to determine the statement water quality in the Lake of Campina and principles methods.

Biological methods for determination	Principle method
The qualitative analysis of phytoplankton	Sampling and species identification
Quantitative analysis of phytoplankton	Determination of algal density and biomass
Qualitative analysis of zooplankton	Sampling and sorting organisms taxonomic groups
Quantitative analysis of zooplankton	Count the zooplankton species in a sample, weighing bodies and extrapolation
Qualitative analysis a macrophytobenthos	Collection of aquatic flora, sorting and species identification
Quantitative analysis a macrophytobenthos	Sampling surface deep squares method. Counting, weighing and extrapolating water macrophytes.

It should be noted that this parameter has indicated biomass of phytoplankton complex.

In this writing were highlighted biological methods of plankton, zooplankton and phytoplankton in the Miresei Lake of Campina. This was studied both qualitatively and quantitatively. As can be seen in the results and discussion, biological parameters of a class of poor quality on phytoplankton acted quickly because it was the most sensitive to the changes in water quality.

RESULTS AND DISCUSSIONS

In July 2012 was taked the first sampling from the lake. The two water samples had been taked at the depth and the surface. During the growth of phytoplankton biomass the water quality in the summer was poor due to the high temperatures. (that was shown in Figure 1.a.). This resulted in overdevelopment of organic matter thus promoting the phenomenon of eutrophycation.
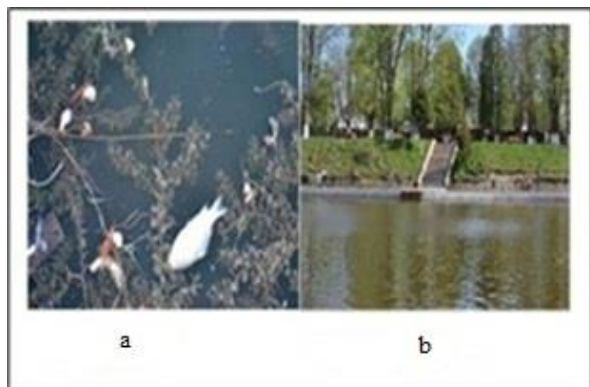

Figure 1. (a and b). Images from the 2012-2013 period at sampling. The Miresei Lake of Campina

Shortly, after the appearance of those problems that have affected water quality were taken measure to modernize and clean the water from the lake to return a state of good quality.
During installation of mineralization organic matter, ie in the second month after the water sampling the quality has changed significantly.

After upgrading the status of water quality had changed since the lake water have been cleaned out of excess algae. (figure 1.b). By default, the H_2S odor disappeared.
According that the Water Framework Directive provides quality five states: high, good, moderate, poor and very poor. For each class assigned a specific color.

Thus, in the table 3 were presented chromatic values resulting from laboratory analyzes.
Further, progress has been made for physico-chemical parameters are mainly responsible for setting environmental quality statement in the period 2012-2013. (Table 3).

Table 3. Physico-chemical indicators, measurement units and their values in the months of analysis (July 2012, October 2012, April 2013). Concentrations are represented by standardized colors for each class quality

No.	Physical-chemical indicators	Unit	Analyse period		
			July 2012	Oct 2012	April 2013
1.	T	°C	18,8	10,2	14,1
2.	pH	-	8,2	8,04	7,9
3.	O_2	Mg O_2/l	4,62	7,22	7,21
4.	CBO_5	Mg O_2/l	16,2	4,92	5,18
5.	NH_4	mg N/l	1,7	0,81	0,82
6.	NO_2^-	mg N/l	0,27	0,031	0,032
7.	NO_3^-	mg N/l	7,2	3,18	3,06
8.	N total	mg N/l	13,2	7,21	7,22
9.	PO_4	mg P/l	0,48	0,21	0,19
10.	P total	mg P/l	0,94	0,42	0,40
11.	Chlorophyll "a"	μ g/l	136	49,7	51,8

Key: Oligotrophic– green; Mesotrophic– yellow; eutrophic- orange;
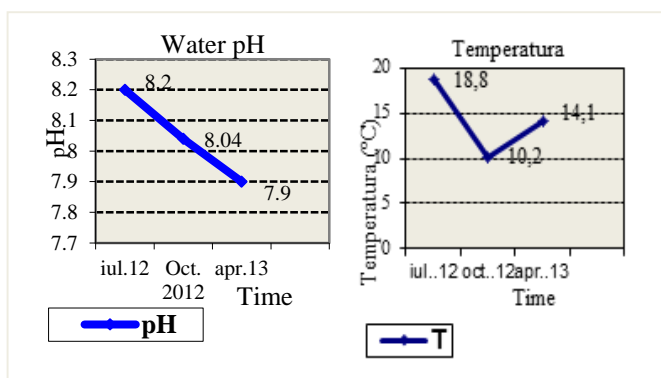

Figure 2. Evaluation of physico-chemical indicators of pH and temperature.

Permissible limit in norm 161/2007 on the classification of surface water pH is between 6.5-8.5. It can be seen in Figure 2 that the water in July 2012 has a pH value 8.2, higher than the other two-month study. In terms of temperature, in July 2012 was 18.8° C, higher than in October 2012 and April 2013.
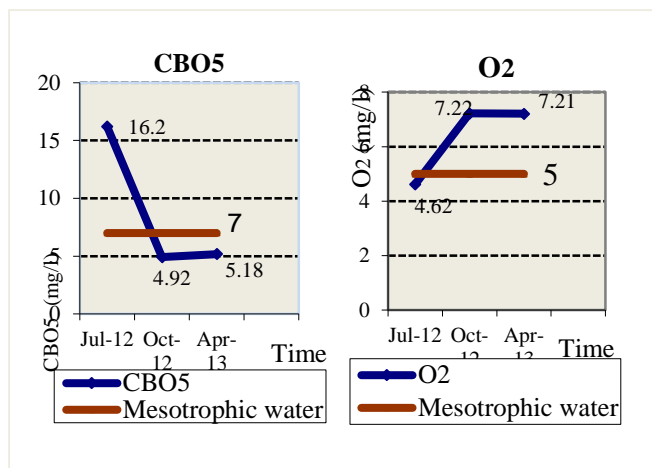
Figure 3. The evolution of the oxygen in 2012-2013 in Lake in Campina. Regime of oxygen is given chemical indicators: BOD5 and 02.

During phytoplankton growth with increasing temperature decreased the amount of oxygen dissolved in water (Figures 2 and 3).

Dissolved oxygen concentration recorded significant growth during the mineralization of organic matter and simultaneously decreased during prevernal period BOD5 concentrations (Figure 3).

In evolution the Miresei lake water the nitrate observed a significant decrease in concentration in July 2012 (7.2 mg / l) which was above the mesotrophic waters at concentrations up to 3.18 mg / l, respectively 3.06 mg / l. (Figure 4.a.)

Figure 4.b. shows the concentration of ammonium decreased in July compared to the other two months. The nitrite concentration during growth of phytoplankton biomass was 0.27 mg /l above the water mesotrophic 0.06 mg / l. (figure 4.c).

The concentration of total nitrogen in water tended to decrease in October 2012 and April 2013 by an oligotrophic character. (Figure 4.d.). The excess nitrogen in July 2012 led to the rapid development of algae.

Referring to Figure 5 shows that in the case of orthophosphates and total phosphorus concentrations in July 2012 has exceeded the mesotrophic waters.

During installation of the mineralization of organic matter and period prevernal concentrations were in quality class second with slight tendencies to third.

Figure 4. Evolution of trophic regime parameters nutrients (total N, NO3, NO2, NH4) in July 2012 in October 2012 and April 2013.
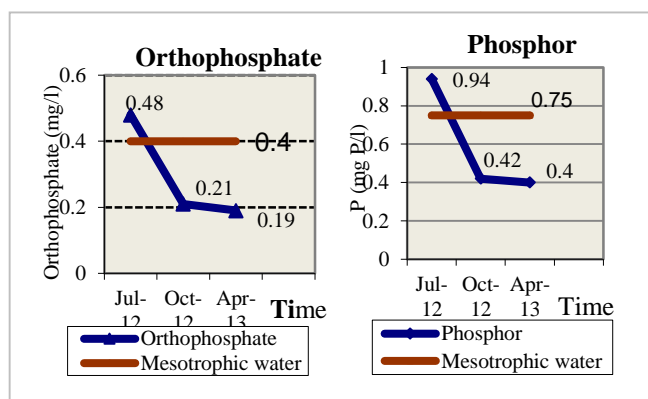
Figure 5. Evolution regime phosphorus (total P and orthophosphate) in Miresei Lake of Campina

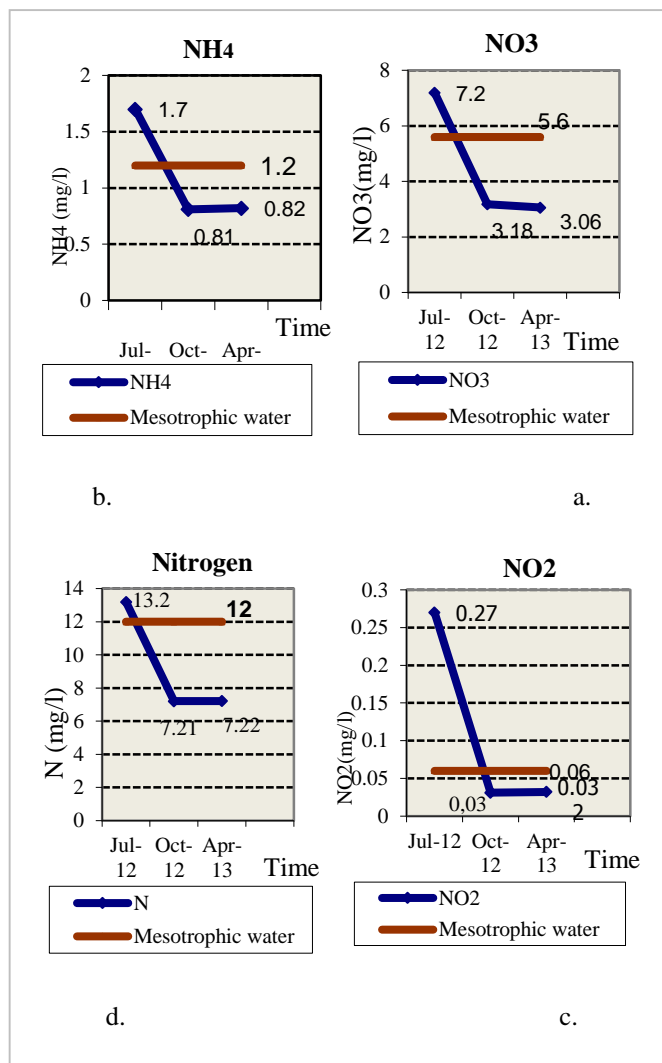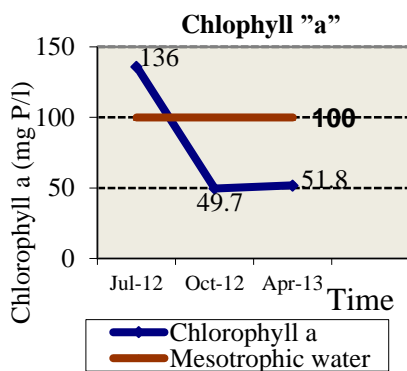Figure 6. Evolution of chlorophyll a in the Miresei Lake Campina in July 2012 in October 2012 and April 2013.

High amount of phytoplankton biomass indicated eutrophic state of water and noted that in July 2012 the concentration was 136 mg/l above the mesotrophic waters. (Figure 6). During installation of the mineralization of organic matter in 2012 and prevernal period in 2013, ie after modernization measures water quality physico-chemical change in second class, and some slight indicators for third quality class.

Table 4. Biological analyzes of water lake plankton and phytobenthos in 2012-2013. Color table is characterized by quality classes.

	The Plankton/ saprobity index	Benthonic algae (Phytobenthos) /saprobity index
July 2012	2,82	2,78
Oct. 2012	2,38	2,37
April 2013	2,36	2,35

Key: Oligotrophic– green; Mesotrophic– yellow; eutrophic- orange;

From the biological results presented in Table 4 highlights that water in July 2012 fall in fourth quality class, and after arranging lake grade of biologically ranged in quality second of quality. To observe in detail the evolution of biological indicators (saprobity index of plankton and phytobenthos) is plotted below.
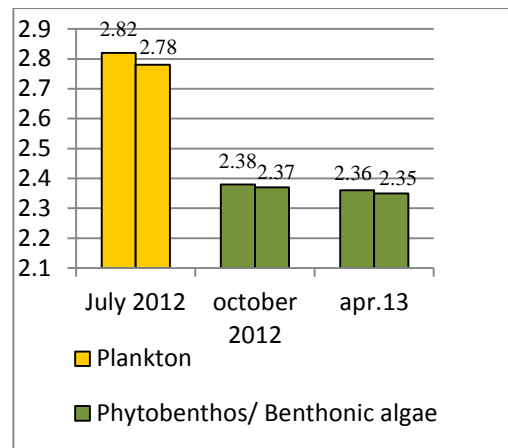
Figure 7. Evolution saprobity index in 2012-2013 during the months of analysis. In July 2012 the high values of the two indicators of saprobity of plankton and phytobenthos (algae bentonite) be identified by yellow color.

a. *Sphaerotilus natans*   b. *Euglena viridis*

c. *Spirulina jenneri*   d. *Metopus sp.*

e. *Oscillatoria sp*   f. *Nostoc sp.*

Figure 8. The Species identified in July 2012 in Miresei Lake of Campina. (X400 microscopic images)

As previously noted in Table 4, the distribution of index saprobity values not uniform. In July 2012 there is a major difference in water quality to two months. (Figure 7). Lake water during the growing phytoplankton fit into a low-class quality, and water was eutrophic character. In October 2012 and April 2013 with slight acquires oligotrophic to mesotrophic.

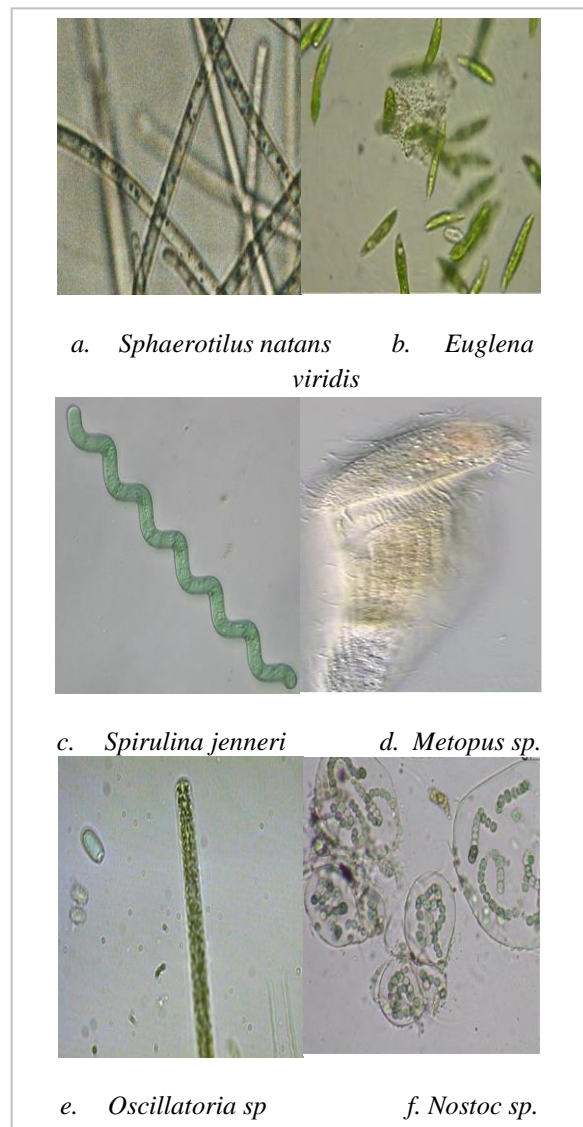Further, were presented species of organisms living in the lake of Campina.

In July 2012, the water was eutrophic character which generated a greater amount of sludge on the bottom, leading to filamentous bacteria *Sphaerotilus natans* (Figure 8.a).

In the lake water were identified and flagellate protozoan species such as *Euglena Viridis* (Figure 8.b) and filamentous cyanobacteria *Oscillatoria sp*. (Figure 8.e) and *Nostoc sp.* (Figure 8 f). By the analysis of water samples that are blue algae *Spirulina Jenneri.* (Figure 8c.).

The eutrophication favors the appearance of bacterial species in sulfur and while the ciliates (*Metopus sp.*, Figure 9.d) that feed with them. The species identified in the lake water during mineralization of organic matter and prevernal period were shown below in Figure 9.

a. *Diatoma sp* b. *Tabellaria fenestrata*

c. *Vorticella campanula* d. *Cladophora crispata*
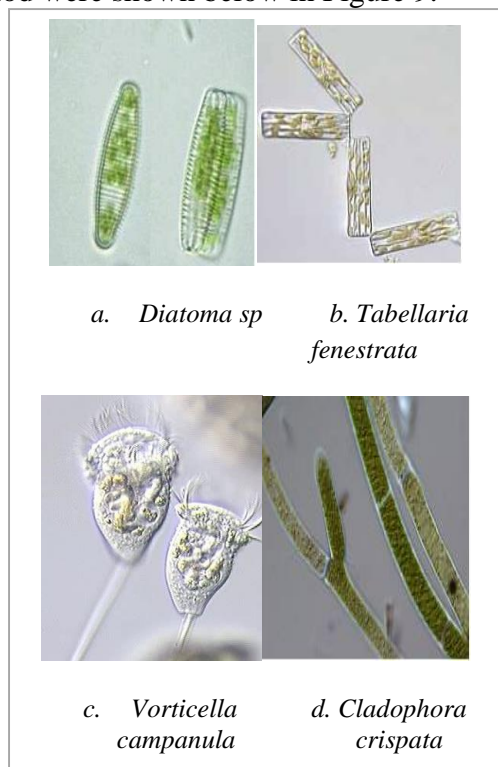
Figure 9. The indicators species of quality class second in the Miresei Lake in October 2012 and Aprilie 2013 (x400 microscopic images)

The biological indicators of water falls in class II quality are represented by species of diatoms (*Diatoma sp*. Figure 9.a. and *Tabellaria Fenestra*, Figure 9.b) cilitate species as *Vorticella campanula* (Figure 9.c.).

By the water sampling identified the species of filamentous green algae *Chladophora crispata. (*Figure 9.d.).

CONCLUSIONS

This writing was based on monitoring and analyzing the water quality in 2012-2013 of Miresei Lake (also called The Church).

Ecological statement was determined by physical, chemical and biological indicators presented in Results and Discussion.

In early research, poor quality water of July 2012 had unpleasant consequences: the species of fish have died without enough dissolved oxygen, appeared smell and unsightly appearance which affect the landscape.

Once you have applied measures of modernization, ecological statement of water changed into a good one and has become an oligotrophic character. Currently, the Miresei Lake gives a pleasant city and a recreational environment for inhibators.

ACKNOWLEDGEMENTS

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*** The UE Water Framework Directive

http://ec.europa.eu/environment/water/water-framework/index_en.html

MONITORING OF NOISE PRODUCED BY BANDCONVEYORS FROM THE MINING UNIT OF CAREER ROSIA

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Abstract

In this paper we intend to make a noise monitoring, produced by bandconveyors, monitorization necessary for finding solutions to combat noise. The main sources of noise pollution are tracked excavators with rotor and bandconveyors. For the urban areas and forested areas the tracked excavators with rotor is not a source of noise pollution. They represent a source of noise just inside the career, because of the way adjacent extraction steps, which is a natural barrier against the propagation of noise. The bandconveyor T111 from the Career Rosia of Jiu, which is transporting excavated material represents a source of noise pollution for residents of the village of Rosia of Jiu due to he`s close location. Exposure to noise for long-term can cause adverse effects on health.

Key words: pollution, noise control, noise attenuation.

INTRODUCTION

Opening of the Mining Unit of Career Rosia began in April 1973, and it is the largest career in Romania and also from the South-Eastern Europe by volume of geological reserves of lignite. Mining Unit of Career Rosia has toughest hydrogeologic conditions in Romania. The Mining Unit of Career Rosia is making part of the coal basin of northwestern Oltenia managed by Trading Company Oltenia Energy Complex - SA, located in the interfluve between the river Jilţ and the river Jiu regularized and developed on a third of the surface in the Jiu valley and the rest is in the hilly part (Stanci, Stanci, Dumitrescu, 2011).

Exploitation perimeter of the Mining Unit of Career Rosia is located on the territory of the administrative city Rovinari and administrative territories of the communes Farcasesti and Bălteni and is part of the mining basin Rovinari part of the mining area Motru-Jilţ-Rovinari, located in northern Oltenia.

In Romania there is a tendency, which also manifests itself in the world: the increase in noise and vibration generation - whose sources appear with impetuous development of all branches of the economy and transportation.

One of the main objectives of modernization of production capacities of mining coal basin of Oltenia is reduction of noise and dust emissions.

THEORETICAL CONSIDERATIONS

Noise pollution is an important component of environmental pollution, both by harmful character and he is present in all day to day activities of modern life. The noise pollution is a major problem for all economically developed countries or developing countries. Noise pollution is a continue aggression, determined by different noises made by machinery, industrial equipment or domestic, inside or outside buildings, noise favored by the placement and their constructive isolation.

One of the disturbing factors of the environment, that influence the environment in which it operates and human life is the noise

which is associated and identified in generally by noise pollution.

Source of pollution, by noise, include:

Use of motorized vehicles to transport workers, materials and equipment to and from career;

Use of mobile machinery and stationary inside of careers, they typically include the tracked excavators with rotor, cross-pit spreader and bandconveyors.

Potential noise receptors typically include mine workers, people outside the open pit limits.

Choice of methods to combat noise is conditioned to the combined between noise sources, the propagation medium (path) of acoustic energy and receivers. In the noise control methods should be incorporated parts of this system, it distinguished: methods of noise control at source, methods of the control of noise on pathways and methods to combat noise at the receiver.

When crossing propagation environment, the acoustic waves lose some of the energy originally contained due to the following physical causes: internal friction of environmental particles which particles enters in oscillation (viscosity), thermal conductivity of the environment, radiation heat and energy of intermolecular exchange.

Attenuation due to viscosity is expressed by a coefficient dependent on the characteristics of the environment but and the frequency of the sound.

$$A_\vartheta = \frac{4\pi^2}{\lambda^2} \cdot \frac{2}{3} \cdot \frac{\eta}{Z_s} \qquad (1)$$

where:

λ - wave length of the given sound

η – dynamic viscosity of the environment

$Z_s = -1\rho \cdot c$ – specific impedance of environment.

In case of bandconveyors sound wavelengths remain unchanged; which varies is the characteristics of the environment due to temperature variations.

Sound attenuation due to thermal conductivity is expressed by the corresponding coefficient of attenuation (expression given by Herzfeld and Rice).

$$A_T = \frac{4\pi^2}{\lambda^2} \cdot \frac{c_T}{2Z_s} \cdot \frac{\gamma-1}{\gamma C_V} \qquad (2)$$

where, in addition to the variables in the expression (1) appear:

c_T – coefficient of thermal conductivity of air

γ - adiabatic coefficient

CV – specific heat at constant volume of environment

Acoustic wave attenuation is achieved by increasing energy level of the gas molecules by putting them in motion of vibration. This variation of the energy depends on the number of degrees of freedom of the molecules, so energy loss increases from monatomic to the polyatomic molecules. Like global effect of sound attenuation in air, Beranek gives the following formula for the additional attenuation:

$$A_S = 7{,}4 \left(\frac{f_m^2 \cdot r}{\Phi} \right) \cdot 10^{-8} \quad [dB] \qquad (3)$$

where:

fm – is the geometric average of the frequency band in which the sound is emitted (Hz)

r – the distance of point of registration to the source (m)

Φ – the relative humidity of the environment (%).

This attenuation is added to the produced attenuation according to the distance from the receiver to the source of sound (Enescu, Magheți, Sârbu, 1998).

RESULTS AND DISCUSSIONS

Noises produced by machinery and mining installations are often uncomfortable for environment (Bratu, 2002). Sources of noise in Mining Unit of Career Rosia equipped with technology in continuous flow can be:

- driving motor and drive the rotor excavators, cross-pit spreader and tractor in motion
- engines bulldozers, loaders and dumpers which acting in career
- bandconveyors

Due to the type of construction and operation of bandconveyors, we have a source of structural noise - rolling noise. Rolling noise is the result of roughness or irregularities from the contact of the rolling surfaces. Spectral composition of rolling noise is broadband. Roller bearings used in the construction of

bandconveyors are the elements with periodic motion that make apear tonal components.
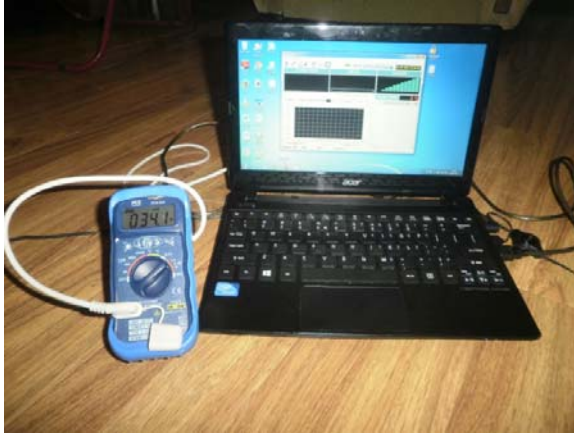
Figure 1 - The digital measuring device 4 in 1

The bandconveyors T111 is a source of noise pollution in the Mining Unit of Career Rosia which is located to a distance of 15-20 m from the first house in the village Rosia of Jiu. In order to find solutions to combat noise pollution produced by the bandconveyors we conducted noise monitoring for a period of 30 days.

In order to monitor noise we used digital measuring device 4 in 1 PVE-222 (figure 1).

The digital measuring device 4 in 1 with multiple functions for the environment has been designed to combine the measurement of the sound level, light, humidity and temperature.

Measurements were performed at different times of day ranging ambient temperature and the humidity.

The noise values where recorded at minimum temperature of 8.5°C near to the bandconveyor and at 10 m from it, graphs are shown in the Figure 2.
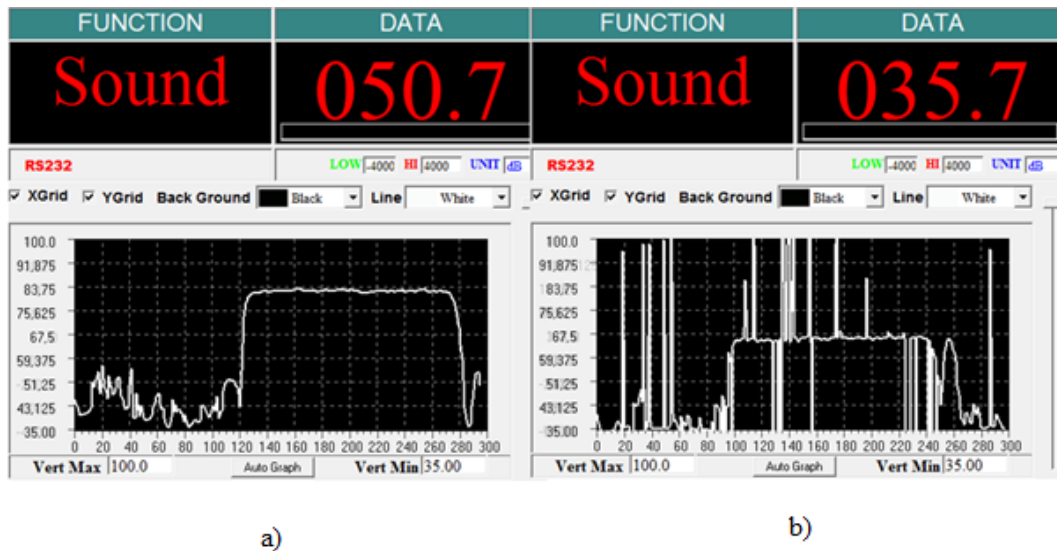
Figure 2 - Values recoroded at temperature of 8.5°C a) near the bandconveyor and b) at 10 m of bandconveyor

For maximum temperature of 17.2°C noise values near of the bandconveyor and at 10 m from it, and the graphs are shown in the figure 3.

Measurements were performed in accordance with STAS existing, during the day, and were calculated using the relation (Stanci, 2012):

$$L_{equivalent} = L_{max} - \frac{1}{3}\left(L_{max} - L_{min}\right) \quad (4)$$

According to the equation (1), (2) and (3) change in sound attenuation depends on the temperature and humidity of the environment of propagation of the sound.

Moisture variation during the monitoring period was between 58.5% and 63.5%, which leads according with relation (3) to noise attenuation between 0.55 dB and 0.59 dB.

Attenuation due to temperature change is significant, with values between 7.74 dB at a temperature of 17.2°C and 19.7 dB at a temperature of 8.5°C at a distance of 10 m from the bandconveyor T111.

a)

b)

c)
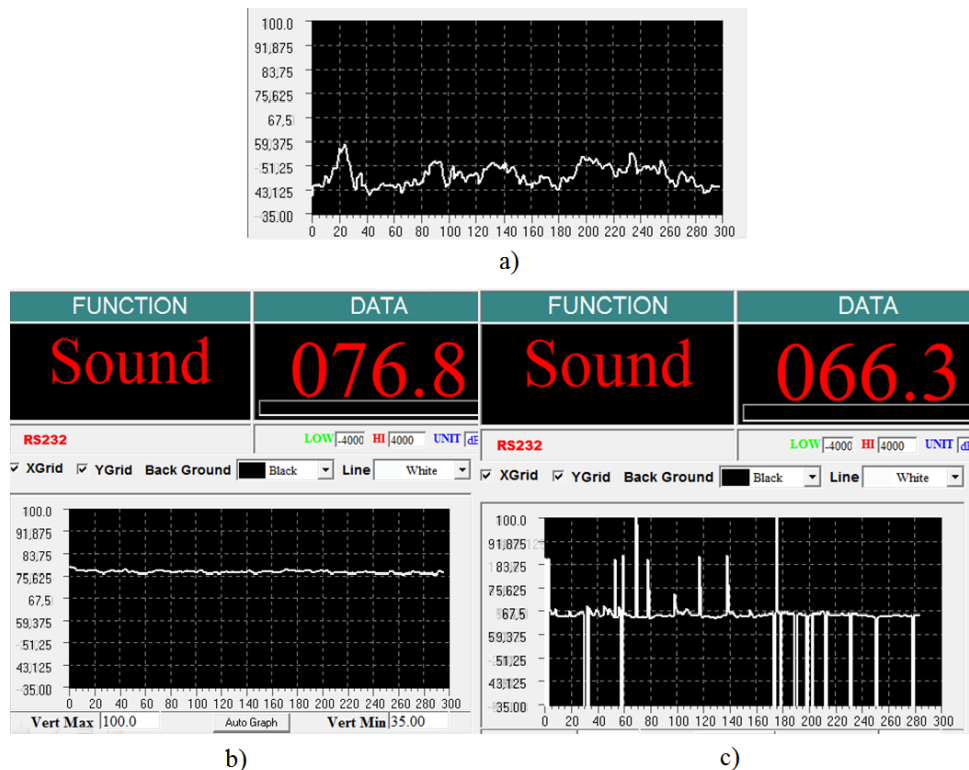
Figure 3 - Values recorded at a temperature of 17.2°C a) before starting work b) near the bandconveyor and c) at 10 m from the bandconveyor

CONCLUSIONS

Noise emission from bandconveyors, passing through village Rosia of Jiu, transporting the material extracted, are producing perturbations in this area.

The value recommended to allowable noise limits, to limit functional urban areas considered as noise sources from adjacent areas (industrial premises) is 65 dB and it is exceeded. The same is with acceptable limits of noise near protected buildings (houses, hotels, hostels, guest houses) which is 55 dB, the first house in the village of Rosia of Jiu is located just 15-20 m of bandconveyor T111.

In result of the monitoring was found that noise limits are exceeding maximum allowable, this endangering the health of the habitants of the village Rosia of Jiu.

Using the data record we can perform calculations for sizing the acoustic isolation and sound absorbing panels to reduce structural noise.

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THE USE OF ULTRAFILTRATION MEMBRANESYSTEMS TO TREATWASTE WATERS GENERATED FROM HARD COAL MINING

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Abstract

The recent studies regarding the membrane technologies indicate that the membrane process applications involve for providing the high quality drinking water and increasing the use of industrial water consumption. Within this scope, it has been considered that membrane treatment systems are necessary for removing the bacteria, viruses, suspended solids causing the high turbidity in water resources and heavy metals such as arsenic and cadmium. In this study, the possibility of using AgNP-PS composite membrane system producing for treatment of waste waters generated from underground coal mining works in Kozlu Hard Coal Basin, Turkey will be investigated. The average 11000 m³ of the waste waters are pumped from 500 meters of underground to surface, daily. The UF membrane filtration system used in the experimental studies was composed of the capillary hollow fiber UF membrane module equipped with Polyethersulphone (PES) membranes purchased from IMT membranes, Holland. In the first stage of the study, commercial membrane was employed and various water quality parameters such as turbidity, conductivity, TSS, Total coliforms, pH, temperature, Total Dissolved Matters, COD and Cadmium concentrations were detected before and after the waste water treated, and each of the membrane performance were calculated. In the second stage of the study, the polysulfone (PS) composite UF membrane will be prepared by phase inversion technique to treat the waste waters and to compare the water quality results obtained from the commercially available UF membrane.

Key words:Polysulfone (PS), silver nanoparticle (AgNP), composite membrane

INTRODUCTION

Membrane filtration is basically based on placing a selective barrier between two phases. As a result of exerting a driving force to one side of the membrane, components are transported towards the membrane surface.Therefore, some components pass through the membrane (permeate) and others are retained according to their size (retentate).In the particular industrial application, different membrane systems and configurations might be arranged, including pretreatments and other treatment stages based upon different technologies, in order to meet those target water quality standards that this industrial application may specifically demand from reclaimed municipal wastewater(Ordonez et al., 2014).

Membrane filtration has developed since 1950s and primarily used in large scale industrial plants for clarifying, concentrating and sterilizing dairy products, oily wastes, alcoholic beverage and brine recovery (Vigneswaran et al., 2012)

İnterfacial polymerization and multilayer composite casting and coating were developed for applying high performance membranes. By means of these processes, membranes with selective layers as thin as 0.1 μm or less are now being produced by a number of companies. Methods of packaging membranes into large-membrane-area spiral-wound, hollow-fine-fiber, capillary, and flat sheet modules were developed. Microfiltration, ultrafiltration, reverse osmosis and electrodialysis were established processes with plants (Baker, 2004).

Ultrafiltration (UF) membranes involve with pore sizes in the range of 0.1 to 0.001 μm and are applied for the removal high of molecular-weight substances, and organic polymeric molecules.

Manufacturers produce membrane moduls using such as a materials (e.g., polypropylene, polysulfone, polyvinylidenedifluoride, polyether-sulfone, cellulose acetate, aromatic polyamide, regenerated cellulose, titanium oxide, etc.) showing different physicochemical behaviors (e.g., mechanical strength, oxidant tolerance, pH operating range, etc.)(Ordonez et al., 2014).

Polysulfone is greatly used polymers in the production of ultrafiltration and microfiltration membranes owing to its properties. Polysulfone have high thermal resistance, good mechanical and chemical stabilities and its superior film-forming properties (Vidaurre et al.,2002; Phelane et al., 2014; Phelane et al., 2014; Goosen et al., 2004).

Polysulfone membranes are usually used as sublayers in composite membrane for reverse osmosis, gas separation and pervaporation. However, polysulfone has hydrophobic characteristic caused membrane fouling which shortens membrane life. Modification of the membrane can be done to develop its hydrophilicity. Technique of modification which can be used to improve hydrophilicity involves modifying the polymer with metal oxides (Phelane et al., 2014; Summers et al.,2001).

Recently, inorganic nanocompositemembranesformed byinorganicparticles, including the size of 1–100 nm, uniformlyemittedina polymer matrix and the membranes use gas separation, pervaporation, andultrafiltration. They show an interesting approach to develop the separation properties of polymer membranes because of possessing properties of organic and inorganic membranes such as good permeability, selectivity, mechanical strength, thermal and chemical stability (Cong et al.,2007).

The structure and performance of nanocomposite membranes are generally a function of the physical and chemical properties of the polymer matrix and nanoparticles due to the method ofnanoparticle incorporation (Shi et al., 2012)

The nanoparticles have been typically produced in aqueous solutions in the by means of water-soluble polymers, where metal ions are reduced either by an added reductant or by the water-soluble polymers themselves (Hazer et al., 2010).

AgNP can be applied by directly coatingto the membrane surfaceor by mixingthepolymer matrixof the membrane duringphaseinversiontechnique (Koseoglu-Imer et al., 2013; Gussemeet al., 2011).

Studies made AgNP-polymeric membrane preparation can be said that AgNPs produced the more hydrophilic membrane and improved the selectivity of membrane (Koseoglu-Imer et al., 2013; Yong et al., 2010; Zodrow et al., 2009).

Some nanoparticles such as silver (Ag), copper (Cu), zincoxide (ZnO), and titaniumoxide (TiO_2) show high toxicity to against microorganisms including bacteria, fungi, viruses, So they have been studied as anti-bacterial agents in different areas (Bao et al., 2011).

According to other nanoparticles, AgNP is widely used in different fields because AgNP has excellent antibacterial performance and low cytotoxicity to human cells (Beer et al., 2012).

The recent studies regarding the membrane technologies indicate that the membrane process applications involve for providing the high quality drinking water and increasing the use of industrial water consumption. Within this scope, it has been considered that membrane treatment systems are necessary for removing the bacteria, viruses, suspended solids causing the high turbidity in water resources and heavy metals such as arsenic and cadmium.

In the first stage of this study, commercially available Polyethersulphone (PES) UF membrane was employed and various water quality parameters were detected before and after the waste water treated, and each of the membrane performance were calculated. Turbidity, conductivity, TSS, Total coliforms, pH, temperature, Total Dissolved Matters, COD and Cadmium concentrations were examined in the raw and treated waste water. In the second stage of the study, the polysulfone (PS) composite UF membrane will be prepared by phase inversion technique to treat the waste waters and to compare the water quality results obtained from the commercially available UF membrane.

MATERIALS AND METHODS

Experimental Studies

In first stage of this study, the possibility of using ultra filtration (UF) membrane systems for treatment of waste waters generated from underground coal mining works in Kozlu Hard Coal Basin, Turkey was investigated. The average 11000 m^3 of the waste waters are pumped from 500 meters of underground to surface, daily. After the waste waters of 35 m^3/hare treated using the UF membrane filtration system, they are used by the mining workers for the bathing. The UF membrane filtration system was composed of the capillary hollow fiber UF membrane module equipped with Polyethersulphone (PES) membranes purchased from IMT membranes, Holland. The membrane has a filter area of 50 m^2, average pore diameter of 0.02 μm, inner and outer diameters of 0.9 and 4.3 mm, respectively. During the membrane filtration process, UF membrane system was run at maximum operation pressure of 7.5 bar and trans-membrane pressure (TMP) of 4.5 bar. Chemical cleaning of membrane was automatically carried out using 200 ppm NaOCl and 500 ppm H_2O_2 using chemical dosage pumps in order to avoid the membrane fouling from the microbial contamination.

In the second stage of this study, composite membranes will be prepared by adding AgNP to the Polysulfone (PS) dope solution. Scanning electron microscopy (SEM), contact angle, and atomic force microscopy (AFM) techniques will have used to characterize the membranes. And then various water quality parameters, which are conductivity, TSS, Total coliforms, pH, temperature, Total Dissolved Matters, COD and Cadmium concentrations, will be detected before and after the waste water treated, and each of the membrane performance will be calculated. Laboratory scale membrane flow diagram was given in Figure 1.

Polysulfone UF Membrane Preparation

Polysulfone (PS, Mw_22,000Da), N-methyl-2-pyrrolidinone(NMP) and AgNP were purchased from Sigma-Aldrich. Polyethylene glycol (PEG) having different molecular weight of 4000, 10, 000, 20, 000, 35,000Da were purchased from Aldrich.

PS based UF membrane preparation are added slowly to NMP solvent and is stirred at room temperature for 24 h in order to form a homogeneous solution. PS beads are added into this solution and stirred. For PS membrane with AgNP (AgNP-PS composite membrane) is dispersed in NMP using an ultrasonication probe (ultrasonic bath) at 20 min until completely dissolved. Then PS beads are added to this solution as previously described (Koseoglu-Imer, 2013). Then the casting solutions of bare PS and AgNP-PS composite are spread casted on a glass plate. The casting films are left for evaporation and then the glass plates are immediately immersed in a deionized water bath to obtain polymer precipitation. After then, the membranes are removed from the water bath and washed thoroughly with deionized.
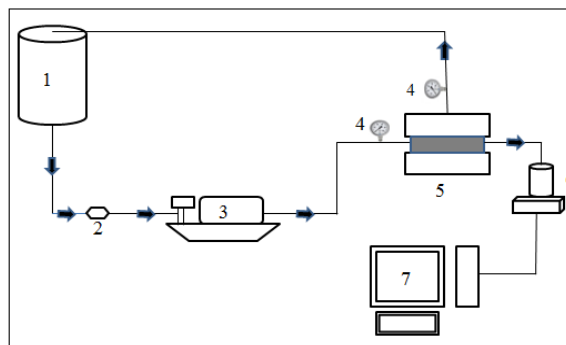
Figure1.Laboratoryscale membraneflow diagram (1.Waste watertank 2. Flow meter3.Highpressure boosters pump 4. Manometer 6.Precision scales 7. Computer)

Feeding raw water to the system from a tank having a volume of 15 L are provided. High pressure pump speed can be adjusted by frequency convector. The desired water pressure in the membrane cell by means of high-pressure pump may be transmitted. Membrane input and membrane output and concentrated on the line pressures to be measured manually manometer and transmembrane pressure (TMP) is calculated. Clean water permeating the membrane is stored in the tank on precision scales and measuring dates are transferred to computer. Also membrane concentrate by means of recycle line issent to the feed tank.

RESULTS AND DISCUSSIONS

As shown Table I, the removal efficiency of total suspended solids (TSS) and turbidity is 99% and 90%, respectively. In other words, the removal performances of TSS and turbidity for UF system were relatively high. In the meantime, total coliform as a bacteriological parameter has been found at the permeate water in the commercially available UF membrane system. Therefore, we will try tocompletely refinetotal coliformbacteria usingAgNP-UFcomposite membranehavingantibacterial properties. As a result, if we remove completely total coliform bacteria andprovidedrinking water standards, waste waters generated from hard coal mining will be used not only bath water but drinking water as well.

Table1. Treatment performance of the commercially available UF membrane system

Water quality parameters	Waste water from underground mining	Permeate of UF membrane system	Removal efficiency (%)
pH	7.2	7.4	
Temperature	21	21	
Turbidity	25	1	99
TSS	48	5	90
COD	48	19	60
Sulphate	202	36	82
Cd	0.044	0.008	82
T.coliform (#/100 ml)	48400	3100	94

CONCLUSIONS

In first stage of this study, the possibility of using ultra filtration (UF) membrane systems were employed to treat waste waters generated from underground coal mining works. It was found that the water quality was good except some bacteriological agents. In the second stage of this study antibacterial composite membrane will be prepared to apply the waste water for comparison of the water quality of both the UF membrane systems.

In addition,it may be need to remove bacteria without disinfectant chemicals via the UF composite membrane prepared with AgNPhaving antibacterial ability.

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SURFACE WATER QUALITY-STUDY CASE RIVER GALDA

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Abstract

Due to the rapid development of the industry and also the settlements along the rivers, their waters reach wastes and even toxic elements that affect water quality characteristics. Pollution from industry is done at all levels: chemically, physically and biologically, thus affecting the normal development of flora and fauna. Changing water quality is achieved by altering the pH, temperature, water turbidity, but also enriching with organic materials content, thereby reducing the amount of oxygen in water, that favors the overgrowth of algae communities, resulting in eutrophication banks. The proposed research theme enroll in scientific concerns of international and national quality control and protection of surface waters against pollution and provides a comprehensive characterization of water quality of River Galda. To better highlight the influence of industry on the river Galda, his course was divided into four sectors from its source to its mouth, each sector comprising settlements developed along the watercourse and one food industry factory, except the first sector, that includes source of the river and a portion without settlements or other pollution sources. This section, first sector, provides information on the quality of river Galda water without the influence of anthropogenically induced pollution and is used as a reference section. To establish the water quality were used physical analyzes, chemical evaluation was done by determining the main parameters of the oxygen regime, parameters concerning nutrients and main ions existing in water. Evaluation of water quality in terms of biological and microbiological study was carried out by community diatoms in Phytobenthos and establishing ecological status of water on saprobic system, and the micro-biologically analyzed colonies of coliform bacteria , E. coli, Enterococci and NTG. As a result of analyzes was performed in framing quality classes stipulated in legislation of each sector analyzed and also established the ecological status of water in each sector, thus achieving a comprehensive evaluation of river water quality Galda, and evolution pollution from the source to the mouth, according to the sources of pollution.

Key words: diatoms, pollution, River Galda,water quality

INTRODUCTION

Water is an important element for the existence of life and human community development. The fact that the first life forms arose in the aquatic environment, the first human settlements were established near rivers and streams, to have the water needed for drinking and needs household, that water is the place where all metabolic processes, the tissues and organs of all living creatures contain water in big proportion proves the role of primary importance in the development and maintenance of the water in life and in development of human community over time. (M. Popa, 2013)

Whatever the use, water must meet certain quality because the existence and development of human society are entirely dependent on this precious resource. Due to rapid development of humanity in socio-economic field, the types of waste discharged into water courses become more diverse: agricultural fertilizers, pesticides, detergents, heavy metals, cyanide, radioactive substances, industrial chemicals, organic matter, etc.. Many of these substances can be harmful or toxic for organisms that lives in the biosphere, and these substances induce the degradation of surface water quality.(Banu A, 2001)

The research theme proposed is part of a broad spectrum of importance, addressing the growing problem of surface water pollution. This research theme investigate the water quality of the river Galda in terms of physical and chemical parameters, represented by the parameters of the oxygen regime, nutrients, parameters on salinity, temperature and

acidification, and toxic pollutants of natural origin; hydro-biological phytobenthos and micro-biological analysis represented by the amount of viruses and bacteria contained in the water.

MATERIALS AND METHODS

The study was made in November 2013, so the results will reflect the specific meteorological and hydrological conditions of that period.

River is studied Galda River , located in Alba County , and is a major right tributary of the river Mureş. Galda river has its source in the tip Negrileasa Mogosului at an altitude of 1364 m , located Trascău mountains. The river has a length of 39 km and a total area of 253 km^2 , crossing along its course mainly limestone relief .

This river was chosen because along its course are formed numerous settlements and factories in the food industry. The appearance of these anthropogenic formations on river banks have a strong impact on water quality parameters affecting quality by the waste water discharged into the river, by waste thrown into the water or deposited on the riverbanks, or spills of toxic substances such as chemicals used in agriculture. The study area is part of the Action Plan for the protection of waters against pollution caused by nitrates from agricultural sources, according to Order 743 of December 12, 2008.

Characterisation of river water in terms of quality investigation was made using data from four control sections , located along the watercourse. The first sector is the control sector, that includes the upper river and its source, the second area is the middle course of the river crossing localities with population more than 200 people in this sector was build a food factory. The third sector is the lower course of the river, that cross localities with a population of about 1,800 inhabitants and also in this sector is a major industry food factory. The fourth sector, and last, is the lower course of the river that crosses localities with more than 2,800 inhabitants, this sector includes the mouth of the river, and also a food factory in it. Sections aim to highlight critical points regarding water quality, that are located downstream of the major sources of pollution ,

thus providing information on the impact on river water Galda . (Truţa, 2014)

River Galda waters quality characterization was performed by evaluating three factors: water, particles matter and living organisms. Water quality and particle matter as settled by physical and chemical water quality perspective while living organisms and phytobenthos layer analysis was performed by existing microorganisms in water. The analysed parameters, that are representative for the study was conducted in framing appropriate grade using the worst case , based on the results obtained.

Sampling:

Water sampling was done according to Stas 6324, to insure that samples are representative , thus eliminating the possibility of errors in the analysis.

Sampling for analysis of physical and chemical parameters is performed in sterile polyethylene bottles with a capacity of 2 liters fitted with a stopper . Taking water samples for analysis phytobenthos,and micro-biological parameters is done in sterile glass bottle, hermetically sealed. In order to achieve Phytobenthos analysis samples were collected by scraping the substrate immersed in the river for at least 4 week. Handling and preparation of samples were performed according to PGL- 13.

The physical and chemical analysis of water in the study were: thermal regime and acidification, oxygen, nutrients, salinity, toxic substances of natural origin. Other physical and chemical parameters analyzed are: turbidity, color, odor, total dissolved substances, conductivity, total alkalinity, total acidity and total hardness of water.

These determinations were made by potentiometric methods, analytical and instrumental methods and also volumetric methods. Setting class of chemical quality of water is done using worst scenario.

At the time of sampling was determined "in situ" water temperature using an electronic thermometer stem, color and odor of water were determined organoleptically.

The system parameters of the oxygen regime: dissolved oxygen, BOD5 were determined in the laboratory using the Winckler method , and

COD-Mn has been determined by titration with potassium permanganate.

Nutrients class parameters were determined by spectrophotometric methods to achieve analysis using Spectroquant NOVA 60 (SQ) SQ specific kits .

Salinity class parameters were determined by complexometric titration using complexone III EDTA solution 0,01 M and murexide indicator. Using the volumetric titration with EDTA complexone III was also determined and water hardness. Acidity and alkalinity of the water was determined by titration with NaOH 0.1 N and HCl 0.1 N solution.

Parameters in natural toxic pollutants, were determined by X-ray fluorescence spectrometry using EDXRF Quant'X ARL spectrophotometer (Thermo Scientific, USA).

The turbidity of the water was determined using a HI88713. Total dissolved substances, conductivity and pH were determined by means of the multi Hanna HI station 4522 .

Assessment of the ecological status of the river Galda was achieved by Pantle-Buck method . Phytobenthos study was performed using a microscope Optec B.03 at 1000x magnification. The analysis consisted of identifying and counting species prevalent category of benthic algae using saprobic system developed Marsson Kolkwitz, and after that was done the assessing of ecological status of the river and corroborating the results obtained with the values of the physical, chemical and micro-biological water to be placed in class quality.

Analysis of microbiological parameters was performed by standardized and approved methods. Determination of the total number of bacteria was done according to SR EN ISO 6222/2004. Detection and conting of Escherichia coli and Coliform bacteria was performed according to EN ISO 9308-1/2004, SR EN ISO 788-2/2002. Identification and counting of Enterococcus was performed by membrane filtration method according to SR ISO 21528-1/2 2004.

RESULTS AND DISCUSSIONS

By applying the methods presented, were determined the relevant parameters for establish river water quality Galda, to assess ecological status and classification in an appropriate quality class of each sector in the study. Classification in quality class was done according to the laws in vigor and the maximum limits for the parameters considered in each class quality (Table 1).

Table 1. Maximum limits and quality class for physical and chemical parameters

Quality parameter	U.M	Quality class				
		I	II	III	IV	V
Thermal and acidification						
Temperature	°C	not standardized				
pH		6,5-8,5				
Oxygen						
Dizolved oxygen	mg O_2/l	12-14	10-9	5-4	5-1	0
BOD5	mg O_2/l	3	5	7	29	20,01
COD-Mn	mg O_2/l	5	10	20	50	50,01
Nutrients						
Ammonium	mg N/l	0,4	0,8	1,2	3,2	3,20
Nitrite	mg N/l	0,01	0,03	0,06	0,3	0,30
Nitrate	mg N/l	1	3	5,6	11,2	11,20
Salinity						
Calcium	mg/l	50	100	200	300	300,1
Magnesium	mg/l	12	50	100	200	200,1
Toxic pollutants of natural origin						
Zinc	µg/l	100	200	500	1000	1000,1
Iron	µg/l	0,3	0,5	1	2	2,01
Copper	µg/l	20	30	50	100	100,1

Framing saprobic and ecological status assessment is performed using the Pantle-Buck method (Table 2):

Table 2. Pantle-Buck method for establish ecological status

Saprobic index	Saprobic zone	Contamination	Quality status	Ecological status
1,8	o o-b	absence low	I	Very good
2,3	b	moderate	II	Good
2,7	b-a	moderate to critical	III	Stisfy
3,2	a	strong	IV	Moderate
>3,3	a-p p	strong to very strong very strong	V	Very bad

NOTE: *) o= oligosaprobic; o-b= oligo-beta-mesosaprobic; b= beta-mezosaprobic; b-a= beta-meso-alpha saprobic; a= alpha-mezosaprobic; a-p= alpha-polisaprobic; p= polisaprobic

In terms of micro-biological parameters analyzed values are relate to the Directive 76/160/EEC as river water taken in the study is classified as bathing water, according to this Directive (Table 3), we have the maximum

allowable concentrations for the parameters analyzed.

Table 3. Maximum allowable concentration for microbiological parameters

Total coliform bacteria/ 100 ml	E.coli/ 100 ml	Enterococcus/ 100 ml	NTG/ ml
500	100	100	>500

Values of the parameters analyzed in each sector of the river have been reported in those maximum permissible values, under the legislation in vigor, in order to classify the water quality of the river and to establish its ecological status.

Sector 1

After analyzing the physical and chemical parameters were obtained normal values, but also values exceeding limit, according to Norm 161/2006. In Table 4 are the results of water quality assessment of the main elements taken from the one of the river, as stated above norm.

Table 4. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006- Sector 1

Quality parameter	U.M.	Sector 1
Thermal and acidification		
Temperature	°C	-1
pH		7,67
Oxygen		
Dizolved oxygen	$mgO_{2/l}$	12,16
BOD_5	$mgO_{2/l}$	1,15
COD-Mn	$mgO_{2/l}$	18,64
Degree of oxygen saturation	%	80,85
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	0,35
Salinity		
Calcium	mg/l	48,09
Magnesium	mg/l	65,11
Quality class according physical and chemical analzis: II		

From the view of the thermal and acidification, and oxygen, water analysis can be framed in clean water quality class I. Nutrients values are reduced for ammonium and nitrates, but nitrites value is slightly higher due to discharges of manure and waste water directly into the river, or storage of garbage in the river bed. For the parameters from the nutrients class, the first section of river Galda classify in Class I chemical quality of the water.

Quality class II for the river, is printed by salinity parameters. There is a slight high content of calcium and magnesium ions, due to limestone substrate of the river.

In addition to the parameters specified in Norm 161/2006, we have conducted a series of analyzes that are relevant to the study addressed. The values obtained from the determination of these parameters are shown in Table 5.

Table 5. Other parameters relevant for the study - Sector 1

Quality parameter	U.M	Sector 1
Turbidity	NTU	2,39
Color		no color
TDS	ppm	133,3
Conductivity	μS	267,1
Total alkalinity	$mg\text{-}ech/dm^3$	109,8
Total acidity	mg-ech/l	0,4
Total hardness	degrees of hardnesse/ dm^3	7,39

The conductivity is below the maximum permissible value, and is directly proportional to the total concentration of the substances dissolved in the water.

Water alkalinity is due both hydroxides, the carbonates and the bicarbonates. The analysis shows that water is considered medium hard water.

The analysis sample of Phytobenthos for the first sector, were identified following taxa: *Achnanthes lanceolata, Achnanthes inutissima, Coconeis pidicului, Cymbella affinis, Cymbella cestatii, Cymbella lanceolata, Cymbella ventricosa diatomite vulgar, Fragilaria vaucheriae, Fragilaria virescens, Gomphonema angustatum, Gompgonema olivaceum, Melosira varians, meridional circulation, the radiant Navicula, Navicula rynchocephala, Nitzschia dissipated, Nitzschia linearis, Rhoicosphaenia slut, Surilella ovalis, Tabellaria flocculosa*. In total were identified a total of 21 taxa, totaling 500 individuals. Relative frequency, absolute frequency and saprobic index of each species is shown in Table 6.

Table 6. Phytobentos analyses results-Sector 1

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes lanceolata	b	8	1,60
Achnanthes minutissima	o-b	40	8,00
Coconeis pediculus	b	9	1,80
Cymbella affinis	o-b	11	2,20
Cymbella cestatii	o	12	2,40
Cymbella lanceolata	b	13	2,60
Cymbella ventricosa	o-b	9	1,80
Diatoma vulgare	b-a	27	5,40
Fragilaria vaucheriae	b	1	0,20
Fragilaria virescens	o	20	4,00
Gomphonema angustatum	o	24	4,80
Gomphonema olivaceum	b	130	26,00
Melosira varians	b	2	0,40
Meridion circulare	o	52	10,40
Navicula radiosa	o-b	70	14,00
Navicula rynchocephala	a	10	2,00
Nitzschia dissipata	o-b	26	5,20
Nitzschia linearis	o-b	8	1,60
Rhoicosphaenia curvata	b	10	2,00
Surilella ovalis	b	8	1,60
Tabellaria flocculosa	o	10	2,00
Saprobic zone oligosaprobic	Saprobic index 1,64		Quality class: I

Following the completion of microscopic analysis and related calculations are found ecological state of river water very good in the first sector, which can fit in the oligosapropbic zone as saprobity index calculated.

At the microbiological analysis were identified Coliforms bacteria, Enterococcus, E. coli and Total bacteria within normal limits, classifying this regard, the first sector of the river Galda quality class I . The values obtained from the microbiological analysis are presented in Figure 1.
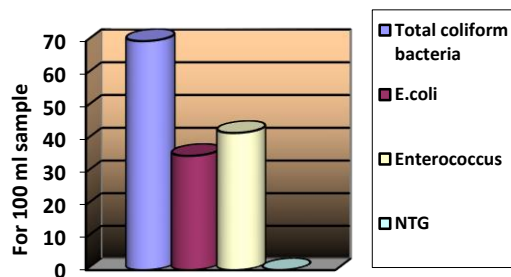

Figure 1. Micro-biological analysis results-Sector 1

These results fit body water in quality class I, with the absence of contamination. It follows therefore that the sector is a sector of reference, with no anthropogenic sources of contamination. Regime in the optimum for normal development of aquatic flora and fauna.

Sector 2

Following the completion of analyzes for water collected from the second sector were obtained the following results for physical and chemical parameters (Table 7).

Table 7. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006- Sector 2

Quality parameter	U.M.	Sector 2
Thermal and acidification		
Temperature	°C	0,1
pH		8,03
Oxygen		
Dizolved oxygen	$mgO_{2/l}$	9,06
BOD_5	$mgO_{2/l}$	6,41
COD-Mn	$mgO_{2/l}$	30,02
Degree of oxygen saturation	%	62,05
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	0,75
Salinity		
Calcium	mg/l	56,112
Magnesium	mg/l	65,115
Pollutants of natural origin		
Zinc	μg/l	1,5
Quality class according physical and chemical analzis: III		

The analysis (Table 7) shows that anthropogenic activities taking place on the banks of river affect water quality, and causes a contamination with organic material, hence a low percentage of oxygen dissolved in water. All chemical parameters corroborated fit Sector 2 of river Galda in quality class III, with pollution levels moderate to polluted environment.

In considering other relevant parameters for the study, reveals a higher conductivity due to existing suspensions in water. These suspensions reveals discharges of wastewater and disposal of various wastes in the river bed. The results are presented in Table 9:

Table 8. Other parameters relevant for the study-Sector 2

Quality parameter	U.M	Sector 2
Turbidity	NTU	1,98
Color		no color
TDS	ppm	176,7
Conductivity	μS	335,1
Total alkalinity	mg-ech/dm^3	91,8
Total acidity	mg-ech/l	0,4
Total hardness	degrees of hardness/ dm^3	8,16

After analyzing the sample of Phytobenthos were identified 20 taxas (Table 9).

Table 9. Phytobentos analyses results-Sector 2

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes minutissima	o-b	42	8,40
Amphora ovalis	a	7	1,40
Coconeis pediculus	b	6	1,20
Cymbella affinis	o-b	36	7,20
Cymbella lanceolata	b	3	0,60
Cymbella silesiaca	b-a	4	0,80
Cymbella ventricosa	o-b	19	3,80
Diatoma vulgare	b-a	91	18,20
Fragilaria capucina	b-o	15	3,00
Gomphonema olivaceum	b	21	4,20
Melosira varians	b	4	0,80
Meridion circulare	o	48	9,60
Navicula cuspidata	b-a	98	19,60
Nitzschia dissipata	o-b	43	8,60
Nitzschia palea	a	2	0,40
Nitzschia pseudofonticola	o-b	8	1,60
Rhoicosphaenia curvata	b	17	3,40
Surilella ovate	b	13	2,60
Synedra ulna	b	9	1,80
Tabellaria flocculosa	o	14	2,80
Saprobic zone oligo-beta-mezosaprobe	Saprobic index 1,90		Quality class: I

After analyzing the sample of Phytobenthos and make the calculations related, was remarked a slight change in water quality from the first sector. This change in water quality is due to arrive in river water discharges from anthropogenic activities, such as industrial and household developed along the watercourse. The species identified in this sector are included in the oligo-beta-mezosaprobic zone with a low contamination with organic material. Ecological status of water in this sector is good for slightly contaminated. Phytobenthos species identified in river water result in a higher consumption of oxygen, which leads to the reduction of oxygen saturation in water and dissolved oxygen content of these. In this sector is affected flora and fauna due to the reduction in oxygen.

Regarding microbiological parameters there was an increase of bacteria in the water (Figure 2).
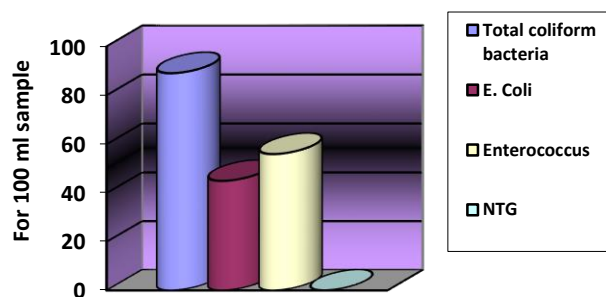

Figure 2. Micro-biological analysis results-Sector 2

Increased levels are due to manure, the food industry factory but also dejection from houses reached in river water.

The results can fit the overall quality of the water sector in Quality class III. Industrial activity in this area and the villages mark the water quality. Quality parameters have values not very much changed from control sector parameters, except the oxygen regyme that have a decrease in the concentration of oxygen in the water, due to the benthos development. This is caused by manure reached the water, including blood from the slaughterhouse in the area, or manure from stables and latrines.

Normal development of existing fish and aquatic fauna may be affected due to reduced oxygen concentration, causing imbalances in the ecosystem.

Sector 3

Sector 3 illustrates even better the influence of anthropogenic activities. Water quality parameters analyzed in this sector are seriously affected, and water quality degradation affects both the environment and local population.

From the analysis of physical and chemical parameters shown a lower quality class due to the degradation of all indicators, illustrated in Table 10.

Table 10. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006- Sector 3

Quality parameter	U.M.	Sector 3
Thermal and acidification		
Temperature	°C	0,1
pH		8,45
Oxygen		
Dizolved oxigen	mgO_2/l	9
BOD_5	mgO_2/l	8,64
COD-Mn	mgO_2/l	16,432
Degree of oxygen saturation	%	61,643
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	2,57
Salinity		
Calcium	mg/l	56,112
Magnesium	mg/l	68,790
Pollutants of natural origin		
Zinc	µg/l	22
Iron	µg/l	4,9
Copper	µg/l	1,3
Quality class according physical and chemical analzis: V		

The main problems identified in this sector are low oxygen content in water, slightly higher values of nitrates and high concentration of iron. For the first two serious problems identified as the main cause is the manure from the food industry factory situated on the river bank, and also the use of chemical fertilizers in agriculture. The existence of iron at so high concentrations in water is due to ferrous metals deposits formed in riverbed due nomads installed here.

The other relevant parameters are normal. There is only a slight increase in conductivity due to the suspension dissolved in water, as is showen in the Table 11.

Table 11. Other parameters relevant for the study-Sector 3

Quality parameter	U.M	Sector 3
Turbidity	NTU	1,59
Color		white
TDS	ppm	176,1
Conductivity	µS	352,2
Total alkalinity	mg-ech/dm³	79,3
Total acidity	mg-ech/l	0,5
Total hardness	degrees of hardness/ dm³	8,45

From the analysis regarding substation shown a high load of the body water with organic matter. In the sample were identified at microscopically analyze a total of 18 taxa, totaling 500 individuals (Table 12).

Table 12. Phytobentos analyses results-Sector 3

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes minutissima	o-b	16	3,20
Amphora ovalis	a	18	3,60
Coconeis pediculus	b	14	2,80
Cymbella affinis	o-b	42	8,40
Cymbella ventricosa	o-b	36	7,20
Diatoma tenue	a	9	1,80
Diatoma vulgare	b-a	53	10,60
Fragilaria capucina	b-o	23	4,60
Gomphonema olivaceum	b	53	10,60
Melosira varians	b	16	3,20
Meridion circulare	o	14	2,80
Navicula cryptocephala	a	15	3,00
Navicula cuspidata	b-a	66	13,20
Nitzschia capitellata	a	54	10,80
Nitzschia palea	a	9	1,80
Surilella angusta	b-a	8	1,60
Surilella ovata	b	27	5,40
Synedra ulna	b	27	5,40
Saprobic zone beta-mezosaprobe	Saprobic index 2,22		Quality class: II

As a result of analysis phytobenthos and associated calculations we find a dominance of species mezosaprobic and the alpha-beta-alpha-mezosaprobic. This is because of the organic matter in water from anthropogenic activity performed in the area. Identified taxa are characteristic for waters with a moderate to pronounced contamination. Due to excessive algal growth, the of water self purification process is slowed, thus decreasing the concentration of oxygen in water, which causes eutrophication banks.

The result of analysis of microbiological parameters reveals a total increase of bacteria in the water. This is due to the accumulated manure and sewage plant in the villages crossed the river. Also the values of other parameters studied a slight increase, as is show in the Figure 3.
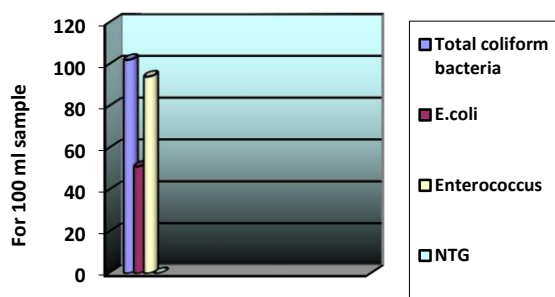
Figure 3. Micro-biological analysis results-Sector 3

After examining the results obtained for the parameters in this sector 3 can be seen how much is influencing the number of inhabitants of a town, the water quality parameters. Anthropogenic activity has left its mark on all the characteristics of water, physical, chemical, hydro-biological and micro-biological. Due to low oxygen content in the water, increase the algal community development, which in time, if there is no intervention will lead to eutrophication banks. Compared to the first sector, in this section is a noticeable degradation in the quality of water, so we can fit it in quality class V, in terms of the combination of the parameters analyzed. Water quality Class V is heavily polluted, and includes waters whose features are modified.

Sector 4

This is the most affected sector due to population abundance installed on the river banks, and also because of the small distance between the two factories placed on the land near river. Water quality is affected because waste water from the two food industry factories and from homes in the area. Physical and chemical parameters recorded sharp declines compared to other sectors (Table 13).
This sector is included in the National plan on the protection of waters against pollution caused by nitrates from agricultural sources, in accordance with Directive 91/676/EEC, due to high levels of nitrates concentration in water and soil.
Oxygen regime shows that river water is heavily contaminated with organic material that consumes oxygen in the water, resulting in 100% biochemical oxygen consumption.

Table 13. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006-Sector 4

Quality parameter	U.M.	Sector 4
Thermal and acidification		
Temperature	°C	1
pH		8,08
Oxygen		
Dizolved oxigen	$mgO_{2/l}$	5,12
BOD_5	$mgO_{2/l}$	5,12
COD-Mn	$mgO_{2/l}$	32,548
Degree of oxygen saturation	%	35,955
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	5,1
Salinity		
Calcium	mg/l	66,132
Magnesium	mg/l	95,4
Pollutants of natural origin		
Zinc	µg/l	5,6
Quality class according physical and chemical analzis: V		

In Table 14 are presented the remaining important parameters.

Table 14. Other parameters relevant for the study-Sector 4

Quality parameter	U.M	Sector 4
Turbidity	NTU	2,6
Color		no color
TDS	ppm	233,5
Conductivity	µS	467,2
Total alkalinity	mg-ech/dm^3	103,7
Total acidity	mg-ech/l	0,3
Total hardness	degrees of hardness/ dm^3	11,14

From investigating these parameters shows that water has a high content of calcium and magnesium due to water contamination with chemicals and dissolution of these salts from the substrate of the river, which print high water hardness. The dissolved material causes a high conductivity of water in this section.
The analysis phytobenthos observe a predominance of the alpha-mezosaprobic species, which indicates critical water pollution. Microscopic study were identified 23 taxa, totaling 500 individuals. The results of the microscopic study are showed in the Table 15.

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Table 15. Phytobentos analyses results-Sector 4

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes minutissima	o-b	36	3
Amphora ovalis	a	5	2
Coconeis pediculus	b	20	2
Cymbella affinis	o-b	28	3
Cymbella silesiaca	b-a	7	2
Cymbella ventricosa	o-b	15	3
Diatoma vulgare	b-a	65	4
Fragilaria capucina	b-o	10	3
Fragilaria pygmaea	a	7	2
Gomphonema olivaceum	b	17	3
Gomphonema parvulum	p	21	3
Gomphonema truncatum	b	5	2
Navicula cinta	a	10	2
Navicula cryptocephala	a	13	2
Navicula cuspidata	b-a	87	4
Nitzschia capitellata	a	58	4
Nitzschia dissipata	o-b	29	3
Nitzschia palea	a	2	1
Nitzschia pseudofonticola	o-b	2	2
Surilella angusta	b-a	10	2
Surilella ovata	b	13	2
Synedra ulna	b	11	3
Tabellaria flocculosa	o	11	2
Saprobic zone beta-mezo-alfa-saprobe	**Saprobic index 2,32**	**Quality class: III**	

From analyzing phytobenthos appears that water has a high impurity whose value tends to critical. This is mainly due to waste and manure that reach in river Galda waters. These hydro-biological results combined with oxygen regime bring out a critical contamination of river water by throwing animal wastes or other wastes in water. In this way oxygen level decreases with materials putrefaction. Once the oxygen level drop is seriously affected both flora and aquatic fauna and hold back the photosynthesis processes and gas traffic. When sampling was taken I noticed a sharp eutrophication banks. Due to poor water quality, the environment was affected by the disappearance of fish and plants, by degradation of the landscape, and by affecting human health.

In Figure 4 are the concentrations of microbiological parameters.
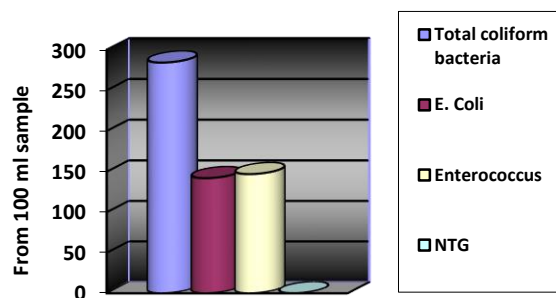

Figure 4. Micro-biological analysis results-Sector 4

Due to this high concentration of bacteria and organic matter in the water, health of the population suffers.

CONCLUSIONS

Today, the concern for the effects of water pollution has increased. Also the effects on aquatic organisms, aquatic biocenosis stability, and on human health represent a global concern.

Analysis of the quality of aquatic systems has proved to be absolutely necessary for both human health and for the smooth running of processes in the natural environment.

Following the survey we concluded:

- Surface water pollution is a serious problem and we have to apply remedial actions, for change the water status from qualitatively weak;
- The largest sources of pollution were found to be of human settlement;
- River Galda face with organic pollution due to agricultural activity carried out in the area, but also because manure and waste waters from food factories;
- Over the river from its source to its mouth can be seen that as the number of residents increases, this increase is reflected in the environment by increasing the number of waste that end up in the river bed;
- In the lower areas of the river, oxygen regime proved to be quite poor because of high organic matter reached the water. This can lead to disruption of the entire aquatic ecosystem, or cause the extinction of some fish species;

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- The most polluted areas are the sectors 3 and 4 located in the lower reaches of the river, as is shown in Figure 5. In this area there were higher values for some indicators due to the raised number of population in this river area;
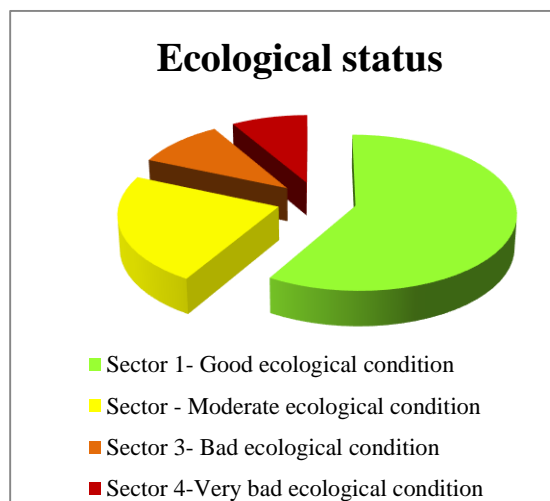
Ecological status

- Sector 1- Good ecological condition
- Sector - Moderate ecological condition
- Sector 3- Bad ecological condition
- Sector 4-Very bad ecological condition

Figure 5. Ecological status of river Galda

- To reduce pollution in this area is necessary to inform people, and especially to educate them for sustainable development, to learn preserve the environment in the best condition possible;

- This pollution does not only affect the environment but also affects tourism and the economy. Due to riverbed degradation remained ruin some camps and camping areas, and nature monuments were buried in garbage.
- Ecological status of the river is heavily degraded over the course of the spring to the confluence with river Mures;
- Both physical parameters, chemical, hydro-biological and microbiological show that have been registrated seriously changes from one sector to another one;
- Chemical and ecological status of the river is degraded due to human activity in the area, if it would stop the pollution, water would regenerate and river banks would again be a tourist attraction because of its beauty and authenticity area.

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PLANNING AND DESIGN OF A SEMI-INTENSIVE GREEN ROOF SYSTEM

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Abstract

The study conducted in this paper is about how to design and realize a semi-intensive green roof system with all the technologic necessary elements regarding: safety, drainage and irrigation systems, substrate and vegetation. Modern green roofs, which require a whole technology for development of plant communities, appeared recently and are improved from year to year. A good design of a green roof should be planning in detail to facilitate implementation process. The result of this study is to design a model used to build for semi-intensive green roofs and also to calculate material requirements and costs.

Keywords: green roof, design, semi-intensive system, implementation

INTRODUCTION

Planting on roofs began in Europe, but it is now becoming popular all over the world. (Dunnett et al., 2004).

In the last five years, the term green roof has taken on ecological and social significance beyond its seemingly simplistic description. As commonly understood, the term has become an epithet for the reduction of pollution and urban heat islands, for large-scale mitigation of storm water runoff, and for maximum utilization of urban land. (Weiler et al., 2009).

In just a few years, green roofs have gone from a horticultural curiosity to a booming growth industry – primarily because the environmental benefits of extensively planted roofs are now beyond dispute, whether for industrial or governmental complexes or for private homes in urban or suburban settings. (Snodgrass et al., 2006).

Engineering design and arrangement of a green roof has advanced every year. Many people are still reluctant when it comes to such a roof mount her, for fear that it would not affect their home, so in Romania there are few companies that offer such services. In recent years in our country began to build green roofs on buildings with different utilities.

To better understand the concept of green roofs need to think about those buildings that have roofs wholly or partially covered with soil and vegetation that grows naturally over a protective layer through which water passes.

A good design of a green roof involves much more than special membrane substrate soil and vegetation. For a long longevity of these roofs underneath the soil can install protective systems that prevents too deep root barriers drainage or irrigation systems.

Green roofs modern technology requires a whole green underneath visible, newly emerging and improved from year to year.

MATERIALS AND METHODS

Green roof design was performed using 2D and 3D design program Google Sketch Up. For materialization of green roof have been used the following: galvanized pipe, fir beams, wooden board, membrane waterproofing and insulation, protective coating, mechanical separation, drainage layer, filter layer, soil and vegetable seeds lawn.

RESULTS AND DISCUSSIONS

To materialize this concept took a detailed design each component layer and substrate. This project was done on the computer step by step with the help of Google Sketch Up. (Figure 1.)

Figure 1. Design 2D

After completing the design of the panel 2D and 3D was much easier to calculate materials and costs necessary (Figure 2.)
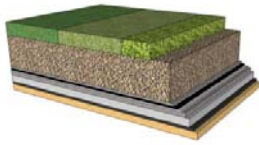

Figure 2. Layers of material

To materialize the design was done a panel with a length of 3 m and a width of 2 m to mimic the smaller roof.

Support panel (Figure 3.) was made of pipe ZN 2 ", over which were installed five fir wood beams caught screwing 10x8 cm at a distance of 66cm from each other.

Figure 3. Installing skeleton layout

Over these beams caught two of 2.5m x 1.5m wooden board, thus achieving basic roof and layout support (Figure 4).

Figure 4. Making panel

On the recommendation of two companies with prestigious planning green roofs, Simacek and Diadem, we used the highest quality materials and durability.

Over wooden boards there have been caught the following protective layers: the top two layers consist of waterproofing membranes and insulation. Such membrane protects against seepage and provides good insulation of the roof. Over these layers to put a protective layer anti-roots for vegetation root systems do not penetrate the protective layers (Figure 5.).

Figure 5. Putting waterproofing

The fourth substrate separation is made, storage and mechanical protection, over which was placed a drainage layer for aeration and water retention with a thickness of 40 mm. This system helps to drain rainwater and excess rainfall, and the irrigation system, avoiding stagnation. Another advantage of this system is that it helps drainage and aeration of the root system of the vegetation. To ensure stability of the system at various inclinations green roof

drainage catch this layer from place to place with iron supports for a better fit.

The sixth layer, the filter layer will be placed over the drain to prevent the passage of impurities and substrate and drain clogging. Above this layer is the filter layer will especially green roofs ground, then it will resemble grass.

Substrate ground, especially for semi - intensive green roofs are composed of perlite, broken pieces of brick, expanded clay and peat. This substrate allows optimal development of vegetation, drainage better and has a higher weight.

For future research is used the same soil substrate for 3 lawn seed mixtures in various proportions. Lawn seed mixtures are: *Poa spp, Festuca spp* and *Lolium spp*. in different proportions.

In order to compare which is more efficient irrigation system studied area was divided into three equal parts that were used as follows: an area of 2x1 square meters to install a drip irrigation system on a surface of a square 2x1 sprinkler irrigation and an area of 2x1 square not mounted any irrigation system.

The cost of a well designed and installed green roof varies depending on the building structure and type of existing roof, and the plant species to be bred. It is also often take into account the costs related to the aesthetic quality of coverage, some spectacular species requiring special care and attention. Such semi- intensive roof cost 100 euros per m^2 , and can reach up to several thousand , to an extensive system cost is decreased about 50 euros per m^2. System costs not included.

CONCLUSIONS

Making a green roof scares many because I do not know the details of how to realize such a roof and proper care. All these details are currently available on the internet or specialized companies in the field.

The materialization of a green roof is pretty easy and has many benefits for home and for our environment.

Ecological advantage of these green roofs is that a green roof retains and recycles rainwater, thus avoiding overloading the sewage system. A much better method of storm water management is to recycle water for irrigation these covers on sunny days.

The realization of this concept has been done to study infiltration, nutrient analysis drained of excess water, the studies on the benefits of each irrigation system in part, materialization and maintenance cost comparison between a tile and a green roof.

The model was made and to be used as teaching material as related Botanical Garden is located in the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca campus.

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SECTION 03
CADASTRE

DIGITAL LIBRARY USED IN LAND SURVEY MAPPING CONTAINING SCALABLE SYMBOLS, LINETYPES AND HATCHES AIMED FOR CROSS-PLATFORM USE AND COMPATIBILITY

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Abstract

The aim of the research is to create an complete, annotative (scalable), cross-platform library that can be imported and used in the most common CAD softwares (AutoCAD and it's variants, ArcMap, Corel Draw etc.). Currently, inserting the conventional map signs and symbols at scale in a CAD environment presents a problem to the average surveyor. There is no annotative complete library of these symbols present in any software, him having to resort to custom made librarys of incomplete list of the signs, markers and linetypes, third-party applications that are often incompatible to his CAD software of choice, or don't meet the specified requirement. In the cross-platform library were incorporate the following attributes to all the conventional signs used in different land survey domains: uniqueness (most important attribute), permanence, simplicity, ease of maintenance, flexibility and reference to geographic location. The content and format of the final product may be carried out in a variety of ways, depending on the scope and magnitude of the mapping projects (surveying, cartography, photogrammetry, landscape design, forestry planning etc). Regardless, the cross-platform library suits to how the mapping function is performed, specifically assigned to project plan development to serve as the organization's blueprint.

Key words: conventional signs, markers, linetypes, mapping projects, project plan development

INTRODUCTION

Land surveyors, architects, cartographers, landscape engineers, construction engineers and many other professions use digital map symbols in accordance with The Conventional Signs Atlas (Bucharest, 1978) in their CAD drawings and projects. These symbols haven't been integrated and standardized in the various software applications utilized by each respective profession. Therefore, the following paper addresses the concept of a cross-platform digital library of map symbols that simplifies import-export operations of the drawings and projects and encourages inter-professional collaboration.

The conventional sign is a geometric figure with size and figure established conventionally, which aims to suggest the image and nature of a topographical object or detail. Some topographical details can be translated to scale, containing enscribed a conventional sign.

These are standardized and contained in The Conventional Signs Atlas.

The conventional signs are grouped into 7 categories: geodetic base, urban area details, industrial installations, utilities and boundaries, transportation networks, hydrography, landscape.

Besides the mentioned categories, the conventional signs are divided into:
- conventional signs that do not represent the object at scale (these signs have fixed dimensions, specified in the Atlas):
  - geodetic point signs;
  - culvert signs;
  - signs used for some buildings
- signs with fixed dimensions – for buildings that cannot be represented at scale
- signs for building scale representation
- conventional signs that represent the object from terrain at map or plan scale:

- terrain parcels
- buildings
- roads over a certain width
- conventional hatch signs
  - vegetation: orchards, vineyards, grassland
- soil types

Placing conventional signs on plans or maps is done by the following criteria:
- the real position of terrain elements has to coincide with the center of the conventional geometric sign: circle, square, triangle
- the conventional signs' orientation will be:
  - parallel with the side of the plan for: base points, tv and radio stations, meteorological stations, monuments, etc
  - according to the real orientation of terrain elements: buildings, stadiums, etc
  - parallel with the longest side of the representation: orchards, etc
- the conventional axis sign has to correspond with the topographical axis: railways, roads, bridges, dams, dikes
- the minimum distance between two conventional signs has to be 0.5 millimeters.

MATERIALS AND METHODS

Autocad 2013, CorelDraw X6 and ArcGis 10.1 have been chosen for this demonstration (Fig.1).

Figure 1. Logos of ArcGis 10, Autocad 2013 and CorelDraw x6, from left to right.

All of above use a set of templates and files which contain their respective symbols, line types and hatches. The purpose of this study is to create a set of templates that is compatible with Autocad, Corel and ArcGis and is standardized accordingly to The Conventional Signs Atlas.

Autocad, one of the leading CAD applications, includes a set of powerful tools used by engineers in their designs and plans. Mainly, symbols are inserted as block references, standardized lines (property boundary, building boundaries, utilities, fences, train tracks, etc)

are inserted as linetypes and hatches that define certain areas (forests, lakes, ground and vegetation elements, etc).

ArcMap (ArcGis component) uses a system of .style files that define symbols (base point graphical objects), lines and patterns (the equivalent of hatches in Autocad)

Corel Draw is fully compatible with the Autocad system of symbols with its own addition, the Symbol Manager.

As base material for this paper, the Conventional Signs Atlas or Atlasul de Semne Conventionale was used. It dates back from 1978, its standards still apply today to Romania's land surveyors in accordance to A.N.C.P.I.'s regulations. Firstly and especially, the symbols are used at technical documentations for topographical plans. They have to be inserted correctly and at scale in the digital plan.

RESULTS AND DISCUSSIONS

We have designed a digital library prototype that contains the correspondent symbol, line or hatch for each software used and that can be translated or transferred from one software to the other.

Autocad's Block Editor was a very useful tool in designing most of the symbols, but some third-party applications and .lsp files were also used. Converting the elements in Corel's Symbol Manager was done by saving the blocks as .dwg files and importing them into Corel. But, transferring the library into a .style ArcGis compatible file format was difficult and most of the elements had to be recreated manually in ArcGis.

Linetypes are created in Autocad just like a normal .dwg but can be saved as linetypes during the process.

For hatches, we used a third-party .lisp file that generates pattern files based on a grid, scale and a custom made drawing.
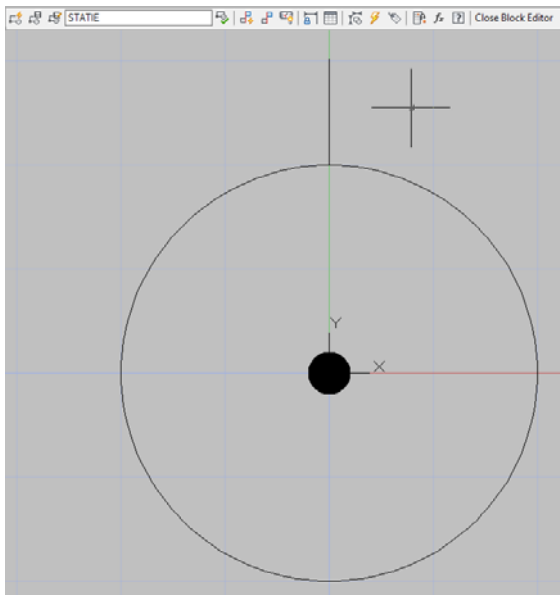
Figure 2. Autocad Block Editor

The purpose of this is, for example, the capability of a land surveyor to open a Corel Draw construction design in Autocad without having to complete the plan by manually inserting the missing symbols. This applies to all other types of designs, plans or digital maps that are supported by the applications and professions mentioned before.

Therefore, our library will be divided into 3 sections: symbols, lines and hatches (Fig. 3). And each entity will have three variants accordingly to the software that will be inserted to.
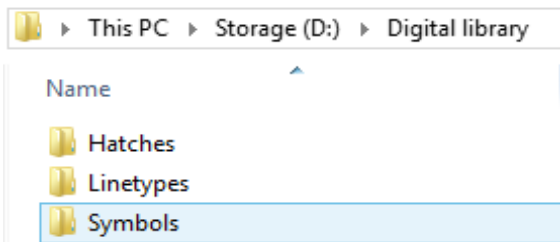
Figure 3. Digital Library Folder Content.

For the library to work in a cross-platform environment the inserted objects have to contain a set of file paths in case they are accessed in a different software then the one they were inserted into.

For example, an AutoCad symbol needs to contain an attribute that targets the corresponding file for opening the symbol in Corel Draw and ArcGis.

Autocad's DXF file format has been created for the purpose of data interoperability between Autocad and other programs. Its file structure contains sections relevant to our paper that can be easily imported into other programs. The way a .dxf file is divided into these sections is very similar to the way a Gis database is structured.

Even more, ArcGis 10.1 has added a geodatabase tool named "CAD to Geodatabase" (Fig. 4) and ArcGis's Data Interoperability Tool is almost completely compatible with the .dxf and .dwg formats.
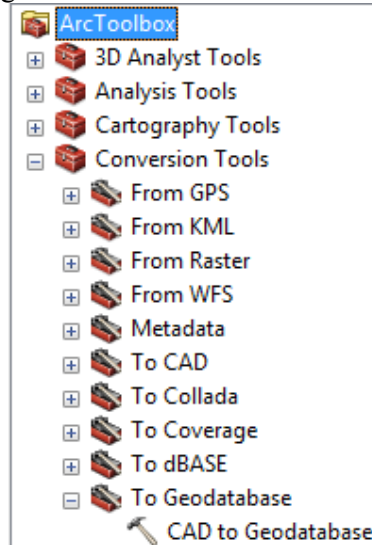

Figure 4. CAD to Geodatabase tool - ArcGis 10.1

The only issue that remains is completing the missing references in the import/export operations and setting an annotation scale to the objects.

We studied the Conventional Signs Atlas and divided most of the symbols and signs into the three sections mentioned earlier: symbols, lines and hatches (Fig. 5,6,7)

Figure 5. Thickening Point of National Geodetic Network
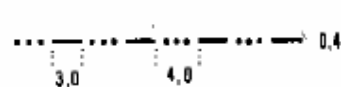

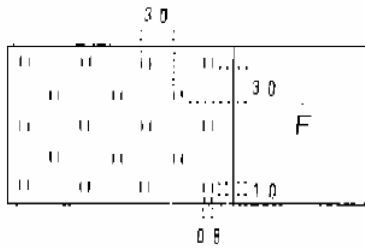Figure 6. Commune Administrative Territory Boundary

Figure 7. Hayfield

Most of the symbols and signs had to be designed accordingly to the dimensions mentioned in the Atlas, and some had more than one version, if their scaling were not directly proportional.

CONCLUSIONS

The library has a very large number of applications and it will be the first digital version of the Conventional Signs Atlas 1978 that is currently used by many professions in their designs.
Some of the applications would be:
- easier collaboration between land surveyors and land designers (Autocad - Corel Draw compatibility)
- easier integration of topographical plans into Specialized Cadastre maps (Autocad -ArcGis compatibility)

- faster and simpler development topographical engineering marking plans based on designs made in Corel Draw
Basically, this digital library proposes the upgrade of a regulation based on analogical source to be based on a digital one.
Most surveyors design their own symbols, keep a partial library in their database and/or copy symbols from one design to the next.
At the moment, most objects designed into our library can be easily transferred from one program to the other but there are exceptions. It is a work in progress, but the result will bring the professions of architecture, land surveying, landscape designing and many others at a higher efficiency and cooperation.
In retrospect, there still is a lack of compatibility between CAD and GIS programs, but improvements can be made.

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ARCGIS ONLINE APLICATION -HIGH SCHOOLS IN PRAHOVA AND VRANCEA TOUR

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Abstract

This paper aims to present an easy method to create an application using the ArcGis Online program implemented by Esri America. The main objective of the project is geographical location of high schools in Prahova and Vrancea Counties. To accomplish this application we have to create an account on the site http://www.arcgis.com, to locate the interest points on the available map, to shoot the respective high schools and to perform techniques steps make this work. Beneficiaries of this project are the students who want to get more information of the high schools they want to follow and the "University of Agronomic Science and Veterinary Medicine of Bucharest "in order to promote the University at this level. As conclusion, this paper aims to improve services by using current technology.

Key words: application, ArcGis implementation, coordinates.

INTRODUCTION

A geographic informational system is a computer system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data with descriptive. (An acronym GIS is used sometimes to understand geographical information science or studies of information geospatial. In simple terms, GIS is absorbed by mapping, statistical analysis and database technology.) Areas of activity for GIS: businesses, governments, educators and scientists, environmental and conservation organizations, natural resource groups, utilities. The GIS technologies have occurred 30 years ago in view of the need to facilitate complex geographical analysis for which existing systems (CAD, DBMS) making processing and analysis of the data space both conventional and remote-sensing, integrated in complex databases, heterogeneous, GIS constitutes only solution by which can solve rational, thoughtful and effective increasingly difficult problems related to the use of resources terrestrial. GIS presents many layers of different information being different from a map where the information what you see is what you get. Another advantage of using this system is that the use of maps is not difficult this operation being similar with paper map with the same symbols and conventional signs. ArcGis Online is a cloud-based system for mapping and geospatial content management. ArcGIS Online base maps are designed to emphasize different views of our world, from physical to political. In this system people can log in, make maps and applications, then share their information with the world with few technical skills and needed materials. It is a content management system for geographic information enabling you to share your content and to power many types of GIS-based applications and end-user websites. Your users connect to these maps and apps to use your shared content that you manage in the ArcGIS Online cloud as well as in your own on-premises systems. ArcGIS Online is used by GIS professionals to publish their information

and bring it to life through the power of intelligent, online maps that encapsulate key sets of geographic information, beautiful cartography, advanced analytics, and workflows. Another advantage of the ArcGis Online Platform is that no matter what you use - desktops, browsers, smartphones, or tablets - you always have access to your content using the Internet. (Jack and Laura Dangermond founded Esri in 1969 as a small research group focused on land-use planning. The company's early mission was to organize and analyze geographic information to help land planners and land resource managers make well-informed environmental decisions). In the year 1993 Geosystems start sharing Esri products in Romania, activity pursued by the firm Esri Romania starting from the year 1999.

MATERIALS AND METHODS

Even the steps for creating this application are relatively simple; the later stage of collecting information, namely their introduction in the main system and achieve attractive graphical interface that is easy to use, is not an easily followed to go and completed without the necessary knowledge. To create this application, we used ArcGIS platform which has an online version (Figure 1) used by Gis professionals to manage and share their apps and geographical information.

Figure 1. ArcGis Online picture

We used as example the tour of high schools in Prahova and Vrancea, thinking that might be useful for future students. The first step forward was to create a free account

http://www.arcgis.com site. After that we have created trapezius map we were interested in then we have added thematic layers to her and the final step in this stage was to save the result (Figure 2).
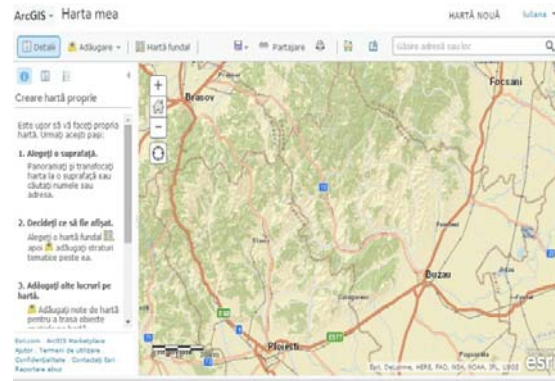

Figure 2: Map Keystone (http://www.arcgis.com –screen shot)

We have created a "Map Tour" application based on aforesaid map keystone. Following these steps, unprocessed version of the application looks as shown below (Figure 3).
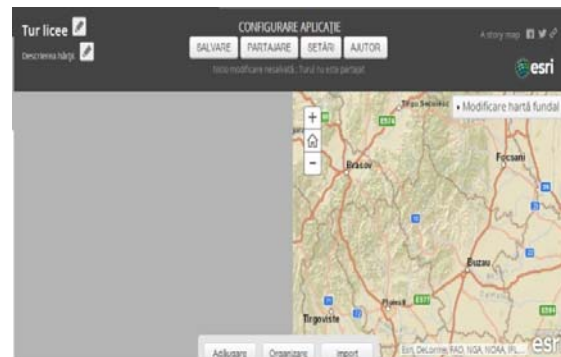

Figure 3. Initial version of the application (http://www.arcgis.com-screen shot)

To give effect of this application we have realized high schools of these two counties photos. The Ideal formats for these photos, recommended by ArcGIS, are 1000x667 pixels for the main picture and 120x80 pixels for the thumbnail. We have done the resizing of photos in "Photoshop" program. We have uploaded them on the web site http://www.flickr.com because we have needed the URL of this. To customize the application, we have added interest points by placing them on the map,

shown in the right sight of the web site page. We have introduced the corresponding URL's, the main photos, the thumbnails and finally we have added a short description about specializations, facilities, level of education and we have shared this with everyone. We can view both the application as well as points on the map, with different symbols (Figure 4).
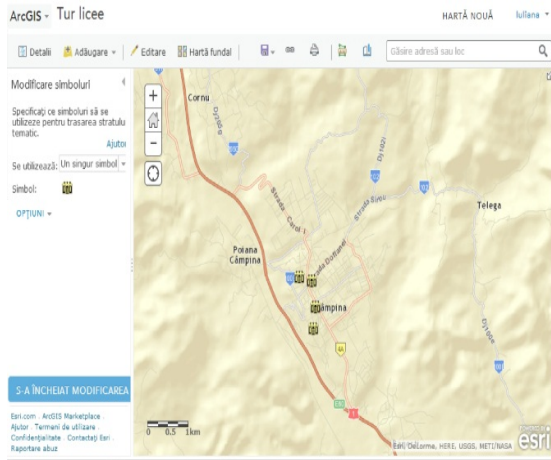

Figure 4: High schools on map (http://www.arcgis.com-screen shot)

RESULTS AND DISCUTIONS

The end result of these steps is the final form of the application (Figure 5). These type of applications have many advantages, from accessibility to the advantage of low cost.
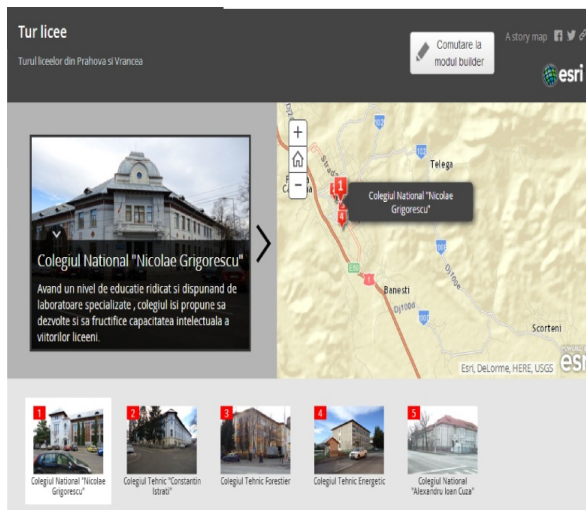
Figure 5: Final form of application
(http://www.arcgis.com-screen shot)

In addition, this service can be used by people who are not specialized in this area , such as: web creators who combine geographic content and tools to build web pages and apps with the data, people without GIS software or training, geographic information specialists for sharing detailed data, analysis models, and tradecraft / workflows with one another, as well as with the broader community, system architects and developers who need to integrate mapping and geographic functionality in their solutions. Also this application could be created in "Esri maps for Office", another product implemented by Esri America that make dynamic maps of your spreadsheet data right in Excel. People can create color-coded, point, clustered point, or heat maps. Then they can share their maps through ArcGIS Online or copy them into your PowerPoint presentation or document. They can also create an organization and share the information only in this. The only difference between the two ways of creating the application is that in "Esri maps for Office" data are entered into an Excel table (which contains fields: name, caption, color IC, main picture URL, miniature URL and coordinates) and then insert this table in "ESRI maps for Office". (Figure 6)
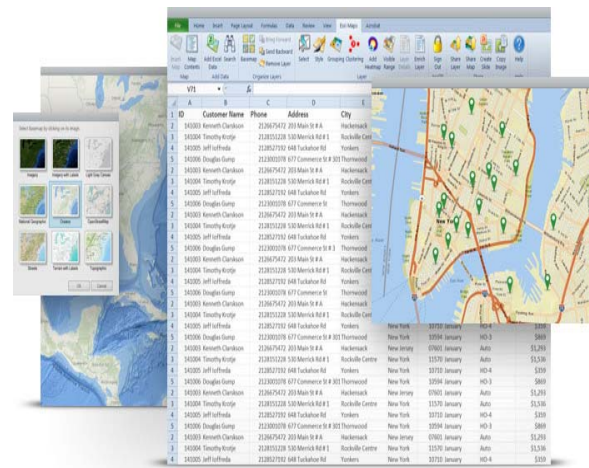

Figure 6: Esri Maps for OFFICE (http://www.esri.com)

CONCLUSIONS

The draft examples of how to work in ArcGis online has been designed specifically to help current students, future students, of these high schools and the University of Agronomy Science and Veterinary Medicine in Bucharest beneficiary's future students, will have the opportunity to learn about services and programs for the study of such high schools and this project will be used for a future caravan for the presentation of the University dropping of these counties. A good information before statues study program will follow in the next few years at the university will help future students to take appropriate decisions for their future.

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CONSIDERATIONS CONCERNING THE TRANSCALCULUS OF THE COORDINATES IN STEREO 1970 PROJECTION FROM KRASOVSKI ELLIPSOID TO THE WGS 1984 ELLIPSOID

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Abstract

The paper presents the transformation of the national system of reference coordinates, STEREO 1970, in the European reference system, WGS 1984, using constant coefficients method. It also presents the difference between the coordinates obtained by the method mentioned above and the results obtained by using TransDatRO program, authorized by ANCPI, application for converting coordinates of STEREO 1970 into ETRS 1989 system, currently used to the whole European continent for GPS measurements.

Key words: transcalculus, coordinates, WGS 84, Krasovski.

INTRODUCTION

Once with the adherence of Romania to the European Union, a problem has risen regarding the shift from the national system of projection to the european one, with the purpose of creating an unitary reference system for the whole european continent.
The projection system used in Romania is the STEREO 1970, which has the Krasovski ellipsoid as reference ellipsoid. The central point of this projection has the coordinates B=46°, L=25° and it is situated near Făgăraş city. In order for our country to have only positive coordinates, the reference ellipsoid is translated to SW such that the origin of the system has the coordinates x=500000 m, y=500000 m.

MATERIALS AND METHODS

The WGS 1984 reference system was created principally for navigation where precision is of 1 m or less. Because of the low precision of the system, ITRS was created, system used for international geodetic determinations, with a higher precision. In concordance with the permanent movement of the continents, which are approaching and moving away from each other with approximately 12 cm/year, the ETRS 1989 was created, standard system used for the GPS measurements in whole Europe. This system is based on the ITRS, the more precise version of WGS 1984, but it changes permanently the origin towards the reference system WGS 1984, that will result in the appearance of differences of the level of seconds.

RESULTS AND DISCUSSIONS

This case study was based on the points' CSA97 and B1 coordinates from Maramureş zone, coordinates obtained by GPS measurements in WGS 1984 reference system. The purpose of the paper is to verify these measurements with the method of transcalculus using constant coefficients, and also verification of the obtained results, with TransDatRO software, transcalculus software authorised by ANCPI.
The first part of the case study contains the transformation of plane coordinates STEREO

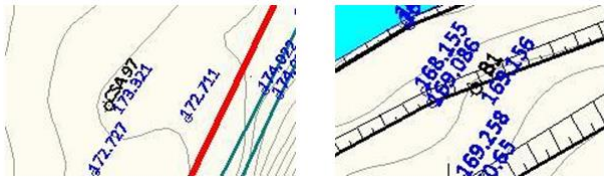70 in geographic coordinates WGS 84, using the constant coefficient method.

Figure 1. Points represented in plane

The first step, in order to do the transcalculus, consists in reducing the Stereographic coordinates to the origin of the coordinate system situated in the projection pole:

$$\Delta x_i = X_i - X_0$$
$$\Delta y_i = Y_i - Y_0$$

Second step consists in passing the stereographic coordinates from the secant plane to the tangent plane (Table 1).

$$x_{\tan} = \Delta x_i \cdot c'$$
$$y_{\tan} = \Delta y_i \cdot c'$$

where:

$$c' = \frac{1}{c} = \frac{1}{} = 1.000250063$$

c' – transformation coefficient from tangent plane in secant plane.

Table 1. Transformation of coordinates from secant plane is tangent plane

Point	Stereographic coordinates		Coord. reduced to the origin of the coordinate system		Coord. in tangent plane	
	X	Y	ΔX_i	ΔY_i	X_{ta_n}	Y_{ta_n}
CSA97	659525,955	373101,293	159525,955	-126898,707	159565,8465	-126930,4396
B 1	659982,537	373383,766	159982,537	-126616,234	160022,5426	-126647,896

Then the coordinates transformation from tangent plane on the WGS84 ellipsoid with the help of the constant coefficients calculated by C. Moldoveanu.

$$f = x_{\tan} \cdot 10^{-5}$$
$$l = y_{\tan} \cdot 10^{-5}$$

It is determined first the values of f and l parameters, and then the value of vectors f and l is calculated.

Table 2. Vector f calculation

	Point CSA97	Point B1
f^0	1	1
f^1	1,595658465	1,600225426
f^2	2,546125936	2,560721415
f^3	4,062747401	4,097731518
f^4	6,48275728	6,557294166
f^5	10,34426653	10,49314885

Table 3. Vector l calculation

	Point CSA97	Point B1
l^0	1	1
l^2	1,61113365	1,603968955
l^4	2,595751638	2,57271641
l^6	4,182102811	4,126557253

Next step consists in summing the products of the elements of vector f with the elements of the first, second, third and the fourth column respectively from the first transformation coefficients table $(x, y)_{stereo1970} \rightarrow (B, L)_{WGS\ 1984}$ (Table 4).

Table 4. First transformation coefficients table $(x, y)_{stereo1970} \rightarrow (B, L)_{WGS\ 1984}$

A00	0	A02	-26,246618253	A04	0,003312513	A06	-0,0000002
A10	3238,8279765	A12	-0,620236752	A14	0,000173545		
A20	-0,256073492	A22	-0,009981972	A24	0,0000057		
A30	-0,066220292	A32	-0,000189282				
A40	0,0000312629	A42	-0,0000033				
A50	0,0000024216						

In order to obtain the latitude difference in sexagesimal seconds the following relationship is used:

$$\Delta B = f^*_{(1,1)} \cdot A_{(6,4)} \cdot l_{(4,1)}$$
$$\scriptstyle (6,1)$$

The latitude of the point is obtained with the formula:

$$B = B_0 + \Delta B$$

$B_0 = 46°$ (the center of projection latitude for the STEREO 70 projection case).

Table 5. Calculation of latitude B

	Point CSA97	Point B1
R1	5167,142472	5181,928024
R2	-43,9235473	-43,73300784
R3	0,009354943	0,009274178
R4	-0,00000083642	-0,00000082531
$\Delta B = \Sigma R$	5123,228279	5138,20429
$B_0'' = B_0 \cdot 3600$	165600	165600
$B_0'' + \Delta B$	170723,2283	170738,2043
$B° = (B_0'' + \Delta B)/3600$	47,42311897	47,42727897
B	47.25.23,22827899	47.25.38,20428966

For the calculus of longitude, vector l has the following form:

$$ l = \begin{vmatrix} l^1 \\ l^3 \\ l^5 \end{vmatrix} $$

Table 6. Vector l calculation

	Point CSA97	Point B1
l^1	-1,269304396	-1,26647896
l^3	-2,045019025	-2,031392934
l^5	-3,294798965	-3,258291203

The products between the elements of vector f with elements of the first, second and third column recpectively from the second table and the transformation coefficients $(x, y)_{stereo1970} \rightarrow (B, L)_{WGS\ 1984}$ are summed up.

Table 7. The second table with the transformation coefficients $(x, y)_{stereo1970} \rightarrow (B, L)_{WGS\ 1984}$

B01	4647,362095	B03	-0,502105603	B05	0,0001124789
B11	75,322023692	B13	-0,0290014238	B15	0,0000112
B21	1,5063168091	B23	-0,0011247887		
B31	0,0290014238	B33	-0,0000365		
B41	0,0005623				
B51	0,000011				

The operations described before are used. The longitude of the point is obtained with the following relation:

$$ L = L_0 + \Delta L $$

$$ \underset{(1,1)}{\Delta L} = \underset{(6,1)}{f^*} \cdot \underset{(6,3)}{B} \cdot \underset{(3,1)}{l} $$

$L_0 = 25°$ (the longitude of the point at the center of projection, in STEREO 70 case).

Table 8. Calculation of L longitude

	Point CSA97	Point B1
$L_0'' = L_0 \cdot 3600$	90000	90000
$L_0'' + \Delta L$	83944,63215	83957,64169
$L° = (L_0'' + \Delta L)/3600$	23,31795337	23,32156714
L	23.19.04,632146862	23.19.17,64168915

The second part of the case study has the role of verifying the results obtained in the first part, using the reverse transformation method namely the geodetic coordinates transcalculus in plane coordinates.

The calculation method is analogue to the first part, just that for the calculus of coordinate x the following values are obtained first:

$$ f = \Delta B' \cdot 10^{-4} = (B - B_0)' \cdot 10^{-4} $$

$$ l = \Delta L' \cdot 10^{-4} = (L - L_0)' \cdot 10^{-4} $$

B, L- latitude respectively longitude of the point obtained in the first part;

B_0, L_0- latitude respectively longitude of the projection center.

Table 9. Calculation of f and l values

	Point CSA97	Point B1		Point CSA97	Point B1
$B'' = B \cdot 3600$	170723,2283	170738,2043	$L'' = L \cdot 3600$	83944,63215	83957,64169
$B_0'' = B_0 \cdot 3600$	165600	165600	$L_0'' = L_0 \cdot 3600$	90000	90000
$\Delta B'' = B'' - B_0''$	5123,228279	5138,20429	$\Delta L'' = L'' - L_0''$	-6055,367853	-6042,358311
$f = \Delta B'' \cdot 10^{-4}$	0,512322828	0,513820429	$l = \Delta L'' \cdot 10^{-4}$	-0,605536785	-0,604235831

Next, the calculation of f and l vectors (like in the case of latitude determination) and making the calculation which will lead to the obtaining of x coordinate in tangent plane. In

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order to obtain the x coordinate in secant plane, the x coordinate is multiplied with the transformation coefficient c=0,99975. For y coordinate, the values of vectors f and l are calculated and then we proceed as in the case of x coordinate determination. In order to perform these verifications, the values from the constant coefficients tables are used for transforming geodetic coordinates in plane coordinates.

Table 10. Coefficients for $(B, L)_{WGS\ 1984} \rightarrow (x, y)_{Stereo1970}$ transfomation

a00	0	a02	3752,0831113	a04	0,3359081	a06	-0,0000576
a10	308753,6625	a12	-99,92634165	a14	-0,06222767		
a20	75,36803068	a22	-6,67476642	a24	0,0002361		
a30	60,21520616	a32	-0,07130343	a34			
a40	-0,014859	a42	-0,0025911				
a50	0,01426069						
a60	-0,0215834						
b01	215175,8308	b03	-23,2134706	b05	-0,00864536		
b11	-10767,65395	b13	-1,92807416	b15	0,0004969		
b21	-128,6581996	b23	0,13160763				
b31	-2,10605469	b33	0,0023711				
b41	-0,0495315	b43	-0,00083				
b51	0,0004263						

After the above verification the coordinates from which we started in the first part were obtained.

Table 11. Calculation of plane coordinates x, y

	Point CSA97	Point B1
$\Delta x = \Sigma R$	159525,954	159982,536
x_0	500000	500000
x	659525,954	659982,536
$\Delta y = \Sigma R$	-126898,7068	-126616,2338
y_0	500000	500000
y	373101,293	373383,766

The last part of the case study contains the transformation of CSA97 and B1coordinates obtained by GPS measurements, with the help of the transcalculus software, TransDatRO and the comparing of the results given by the software, with the data obtained from the above calculations.

Figure 2. *Transformation of coordinates points CSA97 şi B1 with TransDatRO software*

CONCLUSIONS

In order to transform the coordinates in Stereo1970 projection from the Krasovski ellipsoid to the WGS ellipsoid and vice-versa, from the WGS ellipsoid to the Krasovski ellipsoid, the constant coefficients method can be used. Regarding the coordinates transcalculus from Stereo 1970 projection in the ETRS89 projection system, currently used in Europe, TransDatRO is used, transcalculus of coordinates software, created by ANCPI. The working principle of this software is based on transformation parameters that creates a link between the reference system and the coordinates (CRS-Coordinate Reference System) ETRS89 (European Terrestrial Reference System) with the afferent ellipsoid GRS80 and the national reference system S-42 with the afferent Krasovski 1940 ellipsoid.

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THE USE OF GIS IN AVIATION

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Abstract

This work brings into our attention the use of Geographic Informational Systems (GIS) in the aviation field. The paper is based on topographic measurements of Sibiu airport and reveals in small steps the simplicity of realizing a 3D model helped by software like AutoCAD and ArcGIS. The process whose finality consists of the 3D model of the airport, runways and the surrounding buildings is a clear contrast to its numerous everyday applications. From the obstacle limiting surfaces to the creation of an airport 3D map and model implementation at Google Earth, the GIS applications have definitely proved its power into this field, too.

Key words: *Geographic Informational Systems, aviation, Sibiu airport, 3D model.*

INTRODUCTION

For a long time ago, scientists and researchers have been using interdisciplinary methods in order to visualize spatial data. Building a 3D model involves a set of data processing and display techniques that aid in providing reasonable interpretation and analysis of the complex relationships in large spatial data sets rapidly. GIS Data visualization refers to the presentation of data by digital images, vector data, digital elevation models, tabular information, and virtual reality, in either two or three dimensional presentations, static or animated. The main objective of building GIS visual models is to assist in data exploration and real world conceptualization.

Due to the fact that the improvement of aerial operation within and around airports remains a matter of prime importance to the international aviation community and considering the vast areas airports occupy, GIS has various tools for this entire industry. In order to improve data management and facilitate decision making, the GIS applications allow the information to be analyzed and the results are:

- Effective management of planes;
- Stacking of planes in storage or docs;
- A track of scheduled time of the planes and to keep a track of their delay;
- Avoid ground plane collisions;
- Reduce or maintain traffic on ground;
- Efficient navigation of path when the vision is not clear, e.g. in bad weather conditions;
- Analyse the map which predicts the path of the path of a plane.

As outlined above, in aviation and airport industry GIS purposes and solves many complex problems. On the one hand, it is widely used on airports to facilitate management and also storage aircraft or planes. On the other hand, it is helpful in the navigation of the planes and also in movement path of the aircrafts which must be extracted. Last but not least, GIS is helpful in proper and efficient utilization of land available on an airport.

Known in German as *Hermannstadt*, Sibiu has always been the centre of Romania's German minority since medieval times. Today Sibiu is one of Romania's cultural and tourism capitals, attracting tourists due to its wonderful medieval charm. Given the expected increase in passenger volumes it was required to expand the airport, so a new terminal building and a new runway were built. The region of Sibiu is becoming more important for international companies (Figure 1), which are looking toward to invest in manufacturing facilities.
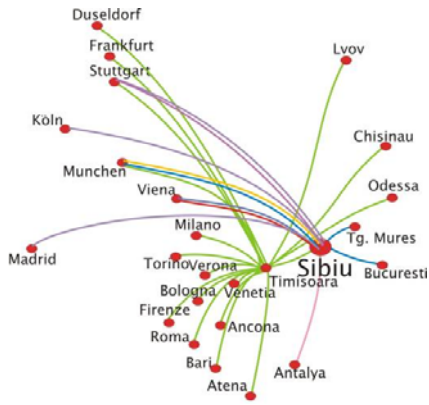
Figure 1. International flights from Sibiu Airport

Therefore a land use plan for the area surrounding the airport was really important. Site surveys, master plans and feasibility studies as well as tender management services were realized.

The object of this paper is to present how a three-dimensional model for Sibiu airport in Romania was developed in order to cope with all the issues an airport implies.
This model (Figure 2) serves as a pilot which can be extended to other local and regional airfields.

Figure 2. 3D view of Sibiu airport in 2007[1]

MATERIALS AND METHODS

To obtain a 3D model of the airport, there were many stages to be executed. In order to achieve the proposed aim we used both CAD and GIS software.
The first step in the development of the GIS model involves an accurate definition of the physical characteristics of Sibiu airport. For this purpose, topographic measurements (X, Y and Z coordinates) were used to define the runways, taxiways, aprons and intersections in AutoCAD. The buildings and the structural facilities were also outlined and provide different points of views. After completing this

step, we obtained a 2D model in AutoCAD, as shown in Figure 3.
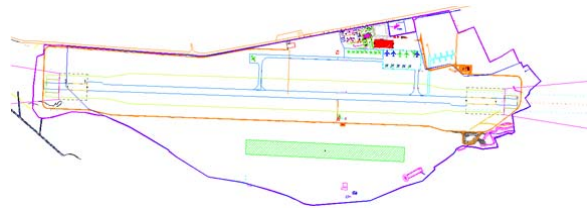
Figure 3. 2D visualization of Sibiu airport in AutoCAD

After this process was complete, the second step involved matching various data sets coordinate systems, data conversion to shapefile, since all vector layers provided were in shape 3D format (either polyline z or point z). It was crucial to convert those data sets to shapefiles as initial stage for using Arc Map. Once the X and Y coordinates were imported in Arc MAP the plan which is defined in Figure 4 was obtained.
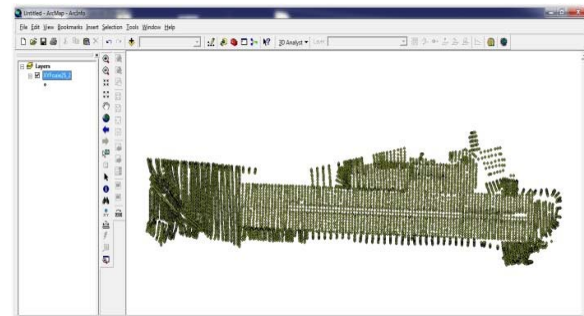

Figure 4. 2D view of the airport in Arc MAP

A TIN model is a triangulated irregular network. In few words, a TIN is a digital structure used in GIS for the representation of a surface. Due to the fact that it is a very clear and easy representation of a model, TIN was used in this case, too. Therefore the file in AutoCAD among with the X, Y and Z coordinates, provided us in Arc Map a TIN model of the airport (Figure 5).
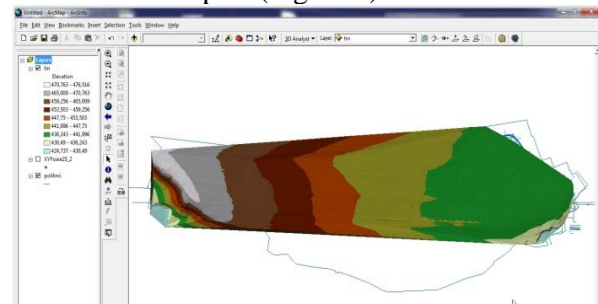

Figure 5. TIN model of the airport in Arc Map

RESULTS AND DISCUSSIONS

The GIS model has made it possible to clearly assess the geometry of the obstacle limiting surfaces for Sibiu airport (Figure 6).
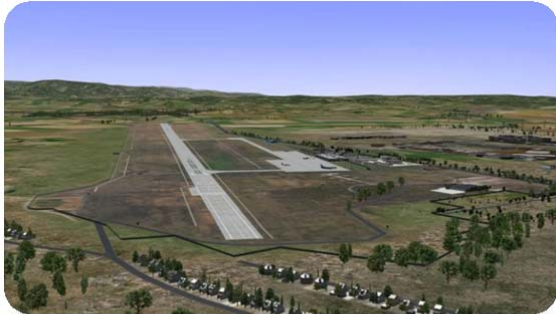

Figure 6. 3D model of the runway [1]

The 3D model allows maximum visualization of obstacle elevations (Figure 7), such as high-tension cables, aerials, built up structures, etc. These surfaces can be obtained with relative ease and accuracy as a function of their distance from the airfield and the height of the terrain from sea level.
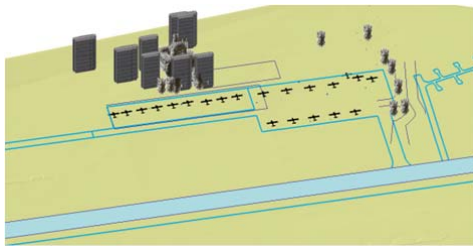

Figure 7. Obstacle elevations near the runway
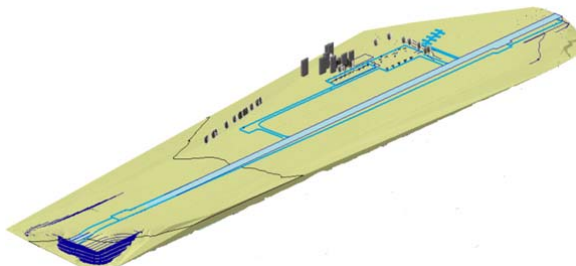
Figure 8. Areas surrounding the airport

The GIS model (Figure 8) also permitted the identification of the cadastral areas which are subject to zoning restrictions. Consequently, it becomes adamant that the airport authority and the Civil Aviation Authority work with these municipalities to ensure that the aerial zoning criteria are properly implemented.

CONCLUSIONS

'The aeronautical community has recognized the acute need for accurate three-dimensional geospatial information in and around the airfield critical to flight safety, specifically for accurate runway positions, obstructions locations and heights, and topography around airfields.' (Wang, Hu and Tao, 2004).

In this paper, the powers of GIS were harnessed for purposes of aerial navigation and zoning in Sibiu. The application of GIS to Sibiu airport made it possible to visualize the 3D geometries of obstacle limiting surfaces and served in the identification of areas that are subject of obstacle height restriction around the airfield. The steps to achieve such a model are easy, as presented in Figure 9.
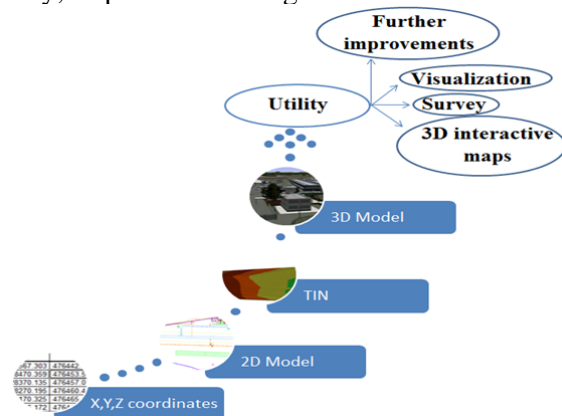

Figure 9. Workflow

What is more, the procedures discussed herein can be applied to the other aerodromes and regularly updated to meet with new requirements. Moreover, this work should be extended to other airports in order to facilitate the decision making and the updates which must regularly be done. If the airports are even bigger than the one Sibiu, a 3D model in GIS could easily provide a 3D map of all the paths to different terminals (Figure 10), therefore eliminate the possibility that people get lost and miss their flights.
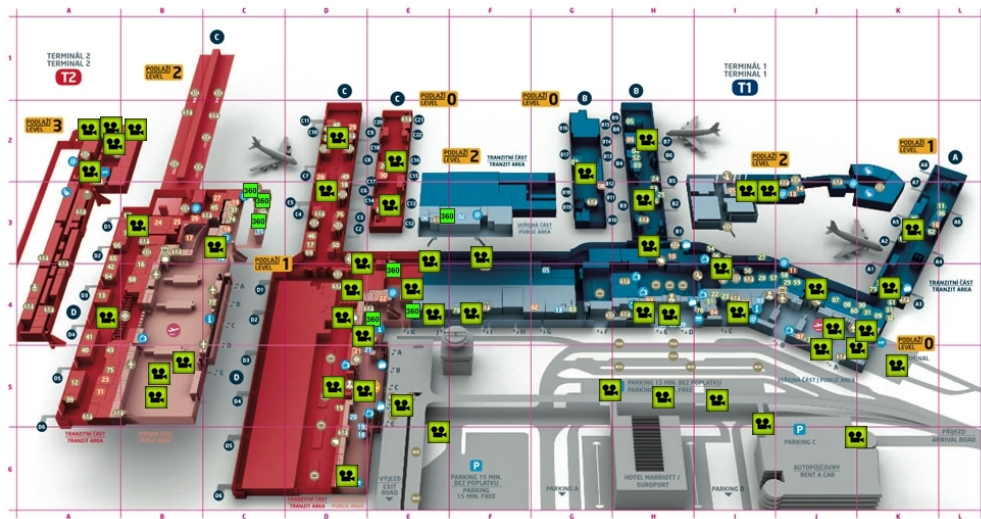
Figure 10. 3D Map of an airport [3]

Additionally, the available GIS can easily be used as a tool to manage the airport facilities, pavements and civil works. Last but not least, the realized 3D model can be proposed to Google Earth so that they can add it to their maps for a better accuracy of the zone that we studied.

In conclusion, topographic measurements among with the appropriate software provide a three dimensional view of airports which can be useful in countless problems. A 3D model can be used by specialists to cope with different problems and in the meantime it can also help the users to better understand their location and have a general view of the airport. GIS is not only the perfect tool to organize the data, but it also allows the visualization of data in such way that is accessible to everyone.

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3D LASER SCANNING FOR MAPPING, BUILDINGS AND HERITAGE

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Abstract

The paper aims to present the generalities and areas of use of laser scanning and its use. Laser scanning technology is among the latest methods of collecting geodata. Is applicable especially in areas which use high precision 3D data. In brief, laser scanning principle is the following: sending a laser beam to measure the distance from the source to the surface or object searched. At the same time, is recorded the direction. By evaluating parameters are obtained information about a specific object on the surface. The laser can be set statically on the ground (terrestrial laser scanning) or a plane or helicopter (aerial laser scanning). For special applications, laser scanners may be located in a vehicle. The main product of laser scanning is a set of 3D coordinates of the points reflected called "point cloud", and with these automatic, semi-automatic and manual procedures, these points are classified by further processing.

Key words: 3D, laser scanning, buildings, mapping, point cloud, coordinates.

INTRODUCTION

Laser Scanning describes a method where a surface is sampled or scanned using laser technology. It analyzes a real-world or object environment to collect data on its shape and possibly its appearance. The collected data can then be used to construct digital, two-dimensional drawings or three-dimensional models useful for a wide variety of applications.

The advantage of laser scanning is the fact that it can record huge numbers of points with high accuracy in a relatively short period of time. It is like taking a photograph with depth information. Laser scanners are line-of-sight instruments, so to ensure complete coverage of a structure multiple scan positions are required. The laser scanner technology can be divided into 2 categories: static and dynamic. When the scanner is kept in a fixed position during the data acquisition, it is called static laser scanning. The advantages of using this method are the high precision and its relatively high point density. All static laser scanning can be seen as terrestrial laser scanning, however not all terrestrial laser scanning can be categorized as being static laser scanning. In cases of dynamic laser scanning, the scanner is mounted on a mobile platform. These systems require additional positioning systems such as INS and GPS which makes the system 13 more complex and expensive. Examples of dynamic laser scanning are scanning from an airplane (airborne laser scanning), scanning from a moving car or from an unmanned aerial vehicle (UAV). (3DRiskMapping, 2008)

In the early stages, laser scanning was short range and mainly used in the automotive and industrial design process to facilitate the Computer Aided Design process. This helped in the mass production of consumer products. Because the obvious advantages of laser scanning like: non-contact measurement, high accuracy, long range, fast data acquisition, etc., other disciplines like cultural heritage, architecture, urban development, forensics, and the entertainment industry are starting to steadily adopt this technology.

MATERIALS AND METHODS

Nowadays, there is no classic procedure for terrestrial laser scanning. Most CAD and modeling programs construct geometry from only a few sample vertices and estimate the rest with design assumptions. Design or modeling packages aid the user in creating entirely novel

models from a conceptual model or idea. Cyclone software provides a high-performance environment for manipulating point cloud data captured by High Definition Surveying (HDS™) systems. Cyclone enables the user to accurately visualize, navigate, measure, and model 3D objects and scenes.

The first time you run Cyclone (Figure 1), you need to create a new database, or connect to an existing database, on the desired server. Databases can reside on your local server or any connected server across a network and stores all Cyclone data including Projects, ScanWorlds, ModelSpaces.
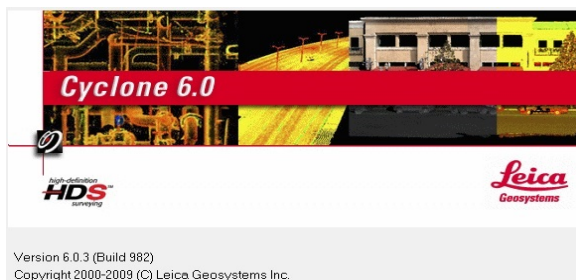
Figure 1. Leica Cyclone software

The key to success in using 3D laser scanning remains the setup and implementation of the right methodology and workflow "fit for the job", combined with the selection of the most appropriate hardware and software.

To collect data in the field was used a Leica ScanStation2 scanner with 4 artificial targets which are the ideal accessories for registration purposes and quality assurance. They allow for accurate geo-referencing of scans to known control points, accurate registration of multiple scans to each other, and valuable quality assurance for individual scans.

Once the site documentation is gathered and laser scanning has been chosen to be the most effective recording technique, the scan and target positions need to be planned.

The optimal locations for the scanning station should be chosen to guarantee a maximum coverage and accuracy while minimizing the number of setups.

Next to the optimal scanner locations, the target types and their positions and/or geometric configuration are also important. Targets are mainly used to register scans taken from different scan positions. Currently there is wide variety of target types available: retro-reflective

targets, spherical targets, paper targets or prism targets.

Before starting the scanning, the scanning device itself was connected to a laptop that can receive and store all the points coming from the scanner and control the properties of the scanner through Leica Cyclone software. This software provides the tools to automatically detect artificial targets in the scan. (3DRiskMapping, 2008).

The Leica ScanStation 2 high speed laser scanner(Figure 2) is fast-becoming one of the most versatile and productive tools in a surveyor's toolbox. This is the only scanner in its class to provide full 360° x 270° field of view from a single scan for added site versatility and productivity and is able to achieve single point positional accuracies to 6mm at 50m, with 300m maximum range.

It fires at 50,000 points per second, the fastest in its class and its sensors automatically compensate the captured scan data for any drift of the scanner from vertical during a scan.

Figure 2. Leica ScanStation 2

RESULTS AND DISCUSSIONS

When a laser scanner is used, the user must have a profound knowledge of the equipment and the scanning process. It is of great importance to double check the scan's completeness when the scanning is finished. Realizing a part is missing in the scan data when at the office may lead to an expensive return visit to the site. The second visit might

require more time than checking the completeness on site during the first visit would have taken.

Before processing the clouds, scans affected by extreme environmental conditions or erroneous scans due to human mistakes are removed from the data set. The scans that are not removed now need to be prioritized according to the 'best views'. The prioritization is done using the field notes and sketches. In most cases, the object to be scanned is too large to be scanned from one position only. Therefore, multiple scanning positions are required. Each scan position is defined in a scanner coordinate system. To be able to align different scan positions, it is necessary to know the exact position and orientation of these scanner coordinate systems according to a local/global site coordinate system.

For this study, as benchmarks I used the Chemistry USAMVB campus building, and the data set was obtained by four consecutive scans, without placing targets in the field.

A way of registering two point clouds is by using point cloud overlap. If two point clouds have enough overlap (generally 30 – 40%), a technique called Iterative Closed Point processing or ICP can be used to align both datasets. (Figure 3)
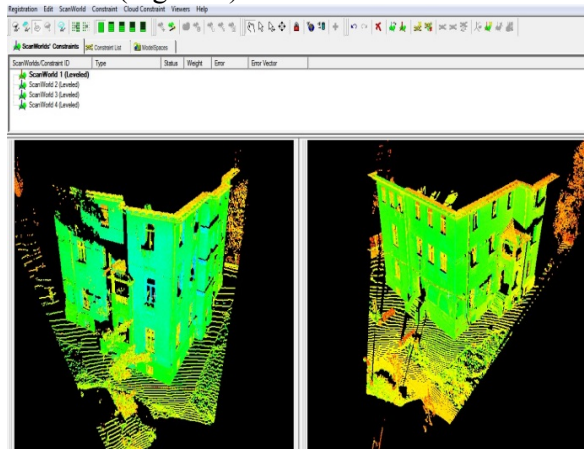

Figure 3. Point cloud registration

This technique required me to manually pick at least 3 corresponding points in the point clouds. Since these 3 points will never be exactly the same points, the ICP algorithm iteratively checks the distances between all the points of the point clouds and estimates the transformation to align both sets thus resulting in minimal error.

After registration, a point cloud processing is needed. Point cloud processing means the process of transforming the raw registered point cloud into a final deliverable. These deliverables come in a wide variety of formats: cleaned point cloud data, standard 2D drawings (e.g. plans, elevations, cross-sections), fully 3D textured models for walkthrough animations. In general, the 3D point cloud processing can be divided into two categories. Deliverables can be extracted straight from the point cloud without further processing, or by first creating a 3D surface model from the point cloud and extracting the deliverables from this surface model. Which method is chosen depends greatly on the required deliverables. For instance, when only a limited number of cross-sections are required, it is better to extract them directly from the point cloud. However, when more sections are needed, the second method is more efficient because there are automated tools to generate multiple cross-sections from a meshed model. (V. Balis, 2004). Furthermore, the surface model adds more value and understanding than just a raw registered point cloud.
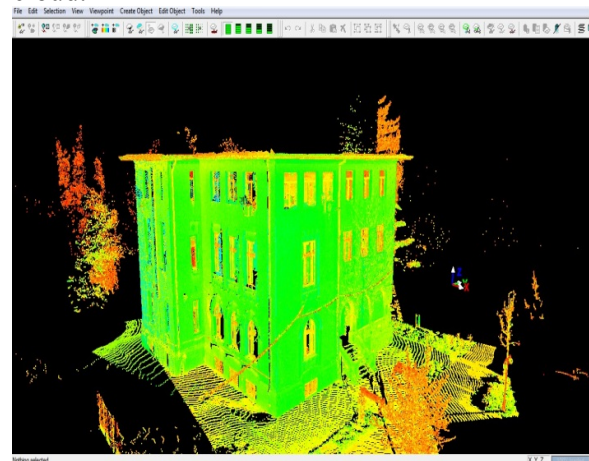

Figure 4. Point cloud processing

The result of a scan acquisition is a huge number of points in space, each having an x, y, z coordinate and usually a laser reflectance value. Some scanners even provide color information in the form of RGB values (Figure 4). The point cloud can be represented by drawing all these points on the screen, but this gives a very chaotic impression and a user will have difficulties recognizing structures from the cloud. When every point is given its

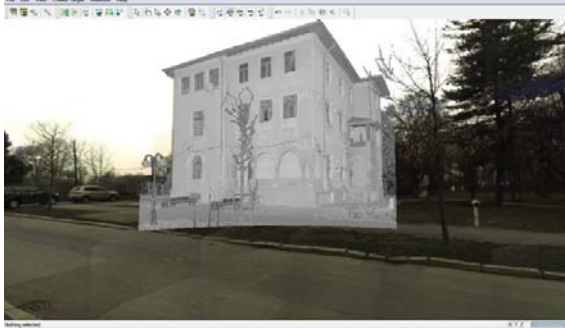reflectance value or a color value, the overall structure becomes understandable. (Figure 5)

Figure 5. Perspective of the measured building (opened in TruSpace).

The primary application that I used is the conversion of point clouds to CAD object-based line and surface models. This various process employed to this end are referred to collectively as "modeling" and are applied via the ModelSpace window. The tools analyze and extract information from point cloud data and convert point clouds to CAD object-based line and surface models.

Then, the point cloud was processed by using the Fit Fenced to Cloud and Fit to Cloud submenu commands. This take only a few seconds to generate a best-fit object by indicate the type of surface to be fit for the selected point cloud, and the fitting algorithms perform a multi-dimensional minimization over the parameter space for the surface type.

For working properly it is necessary to divide or segment a point cloud into one or more subsets in order to focus further operations on a subset, remove unwanted data. Segmentation provides a process for grouping different regions of point clouds based on shared characteristics. For example the points from the north face of the building were segmented because they are unnecessary for subsequent modeling or visualization because they may be stray or unnecessary points.

To extract single points from a points cloud, you need to click on a point to observe its coordinates, because each point has unique X, Y, Z coordinates. The possibility is to import the point cloud or part of the point cloud into CAD, and it is efficient only with relatively small scan data sets. As easy as it is to extract single points from point clouds, you can't be sure that a given scan point is exactly on a corner or an edge, or represents the lowest

point of a curb. Use of a single scan point in this way will depend on the accuracy required.

If even higher point accuracy is needed, then it may be necessary to create a model of the area of interest and derive the point of interest from the model. This is exactly the process that is used to locate the points used for registration. A similar approach can be applied to other objects or features.

For taking distance measurements you need to extract slope distance measurements from any two selected points.(Figure 6) This capability is very useful for quick, approximate distance measurements. Horizontal and vertical distances can also be readily extracted, provided the software has this capability. Again, the accuracy and utility of the distance measurements from the point cloud are constrained by the cloud's point-to-point spacing and the accuracy of each selected point. For more accurate distance measurements, point cloud modeling is needed.
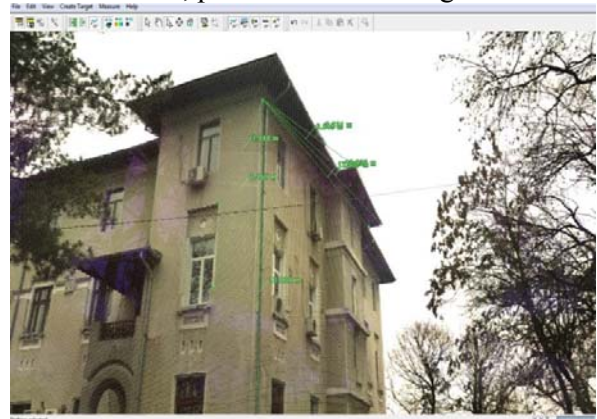

Figure 6. Measure the distance on a building in Cyclone 6.0 software

Extracting volumes from point cloud data can be a highly efficient process, which also yields more accurate volume calculations than traditional methods. Volumes can be extracted between surfaces or between a surface and an assumed plane. The process involves creating surface geometry first and then extracting volumes and surface-to-surface deviations. This latter functionality can also be useful for monitoring surface movements over time.

For extracting surfaces, many types of point cloud software have the ability to generate surface models. (Figure 7) These can be created from meshes or from CAD primitives, where appropriate. Initial work is done within the

point cloud software to clean up the data and to create TIN meshes. Meshes can be decimated intelligently to reduce file size while retaining critical changes in geometry. After this step, the points themselves are often exported to civil design software for creating final DTM deliverables. Although the need to create 3D object models for civil projects is uncommon, the extraction of 3D models from point clouds is quite well developed in advanced point cloud software, as this is where most point cloud processing software began. (Figure 8) Typically, object models generated from point clouds are surface models, cylinders, planes, spheres, steel shapes, other geometric primitives, and arbitrary "catalog" shapes. Tools are also available in advanced point cloud software for applying standard spec tables, such as for piping and steel shapes. Three-dimensional object models are generated "piece-by-piece" from point clouds.
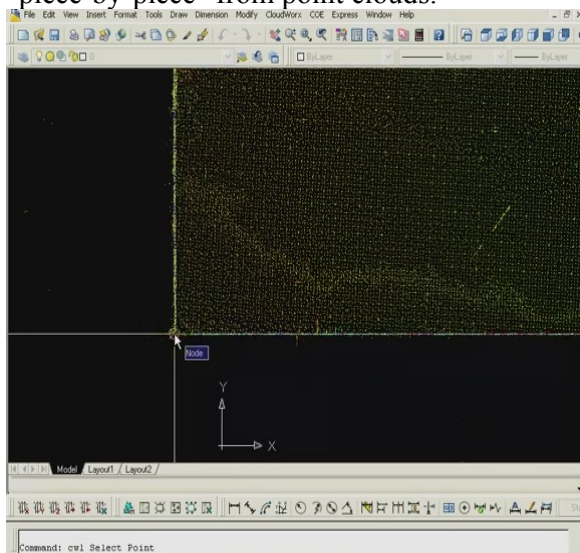

Figure 7. Editing of floor plan of the building in AutoCAD

You can click on a point that obviously lies on the surface of a building and instruct the software to fit a box using all other appropriate points near the selected point. Similarly, you may select a point on a wall or floor and instruct the software to create a plane, and so forth. Three-dimensional models can be exported to intelligent 3D design software that enables the creation of "intelligent 3D models" that represent additional attributes of the object. Three-dimensional models of irregular objects, such as statues, cars, boulders, etc. can also be

created, but this involves more intensive office processing and the use of specialty software. Likewise, texture mapping can be applied to the point clouds or geometric surfaces for photo-realistic models, but this is also generally done outside of point cloud software.
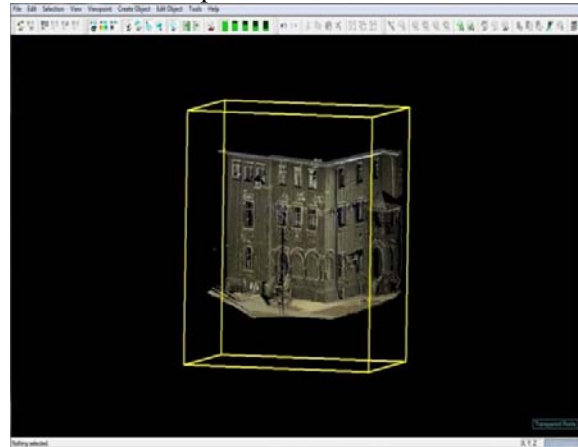

Figure 8. 3D model of the building

Another destination of laser scanning is that you can make case studies about heritage. Cultural Heritage can be defined as monuments, buildings, or landscapes of "outstanding universal value from the point of view of history, art or science." These sites are often under threat from environmental conditions, structural instability, increased tourism and development, and they are most likely under-funded, and hence, inadequately documented and maintained. Laser scanning, in combination with other digital documentation techniques and traditional survey, provides an extremely useful way to document the spatial characteristics of these sites. (Figure 9) This spatial information forms not only an accurate record of these rapidly deteriorating sites, which can be saved for posterity, but also provides a comprehensive base dataset by which site managers, archaeologists, and conservators can monitor sites and perform necessary restoration work to ensure their physical integrity (English Heritage, October 2011).

Figure 9. Use of laser scanning data for presentation of archaeology: Ketley Crag rock shelter (courtesy of Paul Bryan, English Heritage).

CONCLUSIONS

3D Laser scanning is safe because it employs eye-safe laser systems, because the principle of operation relies on the object selective illumination and laser reflection detection with no further interaction with the artwork and yet because, unlike photographic methods it's completely environmentally safe. Also, this is versatile, because can be used with many different materials, except for absolute transparent or reflective objects, in different environments, underwater inclusive, and for a large range of objects size, from archaeological sites, to very shallow and almost invisible inscriptions on stone.

3D Laser scanning can achieve accuracies of few micrometers, in objects of several meters size, allowing for the detection of very small features in the artwork surface and a very detailed documentation of the object.

However the high accuracy of the 3D Laser scanning technology has also associated inconvenient, consisting in the high data content of the image records, being time consuming and requiring high capacity and high speed computers for the image post processing operations.

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INVENTORY OF BUILDINGS WITH HIGH SEISMIC RISK AND POSITIONING THEM ON A MAP USING ARCGIS ONLINE PLATFORM

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Abstract

Bucharest can be ranked as the megacity having the highest seismic risk in Europe due to occurrences of earthquakes originating repeatedly from the same source. The density of tall buildings built in Bucharest before World War II, many being unconsolidated, require a GIS based inventory that could help an eventual intervention in case of a natural disaster and aid the assessment of high seismic risk buildings.
This paper aims to present the use of ArcGIS online platform developed by ESRI to map the high seismic risk buildings situated in the historic center of the Bucharest, known for its many unconsolidated old buildings, and to highlight the benefits of using the GIS technology.

Key words: earthquake, GIS, risk, seismic.

INTRODUCTION

Romania is heavily exposed to seismic hazard, which comes from the subcrustal Vrancea, although there are regions of crustal earthquakes such as Fagaras, Banat, Maramures, but not exceeding 6 degrees on the Richter scale (except Fagaras earthquake of January 26, 1916 the magnitude was 6.4 degrees on the Richter scale). As a result of a statistical analysis of data seismic catalogs, the earthquakes above 7.2 degrees on the Richter scale are repeated about two or three times per century. These earthquakes cause substantial material damage and human victims (Craiu, 2012).

According to the number of people lost in earthquakes during XXth century as well as in a single (March 4, 1977) earthquake during this century (1574 people, including 1424 in Bucharest), Romania can be ranked the 3rd country in Europe. The World Map of Natural Hazards prepared by the Münich Re, 1998 indicates for Bucharest: "Large city with Mexico-city effect". The map focuses the dangerous phenomenon of long (1.6s) predominant period of soil vibration in Bucharest during strong Carpathians Vrancea earthquakes. The Bucharest and Lisbon are the only two European cities falling into Mexico-city category (Aldea et al., 2004). International experts and organizations agreed that Bucharest is the capital city in Europe characterized by the highest seismic risk.

There is a high concern of civil engineers and Romanian Government for the assessment and the reduction of seismic risk in Romania. In Bucharest, the seismic risk is well identified: the most vulnerable buildings are mid and high rise buildings built before 1978 earthquake resistant design code. The buildings before 1941 were built without considering earthquake action, and between 1941 and 1978 the design spectrum was not appropriate for mid and high rise buildings when considering the characteristics of strong ground motions recorded in the city during 1977 and 1986

earthquakes. Romanian Government and local authorities started after 1989 a national program for evaluation of seismic resistance of vulnerable buildings, program that was later integrated into a national strategy for seismic risk reduction. The action of identification of vulnerable buildings is a continuous one. For the buildings for which expert reports are already available, the Seismic Risk Reduction Commission of Ministry of Transports, Constructions and Tourism established priority lists for retrofitting. For example in Bucharest 115 residential buildings were classified as having the highest seismic risk in case of an earthquake similar or stronger to the 1977 one (Vacareanu et al., 2004). Until all the vulnerable buildings will the retrofitted, many of them being part of the Cultural Heritage of Bucharest, a GIS based map is required as it can bring multiples benefits as: a better disaster management, delimitation of the zones vulnerable to earthquakes, a better tool for the real estate industry, etc.

This paper aims to present the possibilities and benefits of using GIS for inventory and assessment of earthquake vulnerable buildings.

MATERIALS AND METHODS

The Bucharest City Hall has published the list of the high seismic risk buildings from Bucharest. From the total of 146 vulnerable buildings we located the main ones from the historic center of the city, the buildings that make the subject of this paper. We have chosen buildings from the most popular streets (e.g. Franceza Street, Lipscani Street, Blanari Street, Selari Street).

A geographic information system (GIS) is a collection of hardware, software, geographic data and personnel, for the acquisition, storage, updating, processing, analysis and display of geographic information in accordance with the requirements of an applied field. GIS is currently the most widely used tool for the analysis and presentation of spatial data from various sources (Doru, 2013).

The chosen GIS platform was ArcGIS developed by ESRI, the free online version (http://arcgis.com) (Figure 1).

Figure 1. ArcGIS.com website screenshot

The addresses published by the Bucharest City Hall was located on the map, and on the ArcGIS platform we added pictures of the buildings and construction details of them (e.g. construction year, height, number of apartments, area, year of expertise, certified expert) (Figure 2).
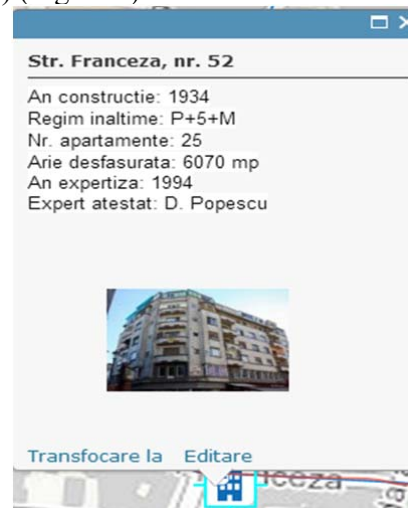

Figure 2. Construction details of a building situated on Franceza St, 52

For the final export we chose the "Map Tour" web application available in the "Share" option of ArcGIS.com website.

Figure 3. Construction details in the "Map Tour" web application

This application offers the possibility to take a virtual tour of all the buildings with high seismic risk from the database (Figure 4).

Figure 4. Virtual map tour

RESULTS AND DISCUSSIONS

Earthquakes have a greater effect on society than most people think. These effects range from structural damages to economic impacts and fatalities. An earthquake only lasts for a few seconds and the aftershocks may continue for days, but the damage does continue for years. Residential site safety and earthquake damage assessment studies play a crucial role for developing reliable rehabilitation and development programs, improving preparedness and mitigating losses in urbanized areas.

A GIS based application that could easily store a huge number of vulnerable buildings with all the required information for a fast and reliable intervention in case of a natural disaster is probably the best choice and the cheapest to implement.

Our example, made with the free online ArcGIS platform, is limited to only the positioning of the buildings on a given map and providing information about them, but with a minimal expense it can easily be developed to a very strong database with a huge quantity of information that can provide the user with a numerous ways to do simulations and virtual models of earthquake disasters that could occur, strategies for intervention in case of an earthquake, etc.

The first step that needs to be done to be able to accomplish this powerful database is the census of population in an area vulnerable to earthquake, with which we can sort the buildings by an age-range. By sorting the buildings in a logical manner, by the age of its inhabitants, we can set the intervention priority list based on the real situation of the buildings.

Another step towards this database would be the assessment of all the earthquake vulnerable buildings located on the route of the intervention teams (e.g. ambulance, firefighters, hospitals, etc.) to help us calculate the quickest and safest route for them by calculating the probability that a certain building could collapse in the event of an earthquake and block the road.

CONCLUSIONS

Considering the disaster of 1977 and the density of old buildings with high seismic risk in Bucharest, we can say without any doubt that such an interactive map based on GIS is essential.

It will prove very useful in case of an earthquake like the one in 1977 and an indispensible tool for the intervention teams.

Taking into account the economic disaster that an earthquake could bring to Bucharest, the expenditure necessary for the implementation of a GIS are very small.

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RESTORING THE BUILDINGS USING THE 3D TEHNOLOGY

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Abstract

There exists a very large amount of damaged buildings in Cultural Heritage in the old Centre of Bucharest. Common damages are related with structural deformations (lack of verticality, crashes, e.g.) and the degradation of the support (deteriorated materials, e.g.). Dense information is needed for both of them. Non-intrusive methods based in laser scans provide a 3d support with dense information with a low human cost. Terrestrial laser scanners deliver a dense point-wise sampling of an object's surface. In many respects, laser scanning follows the same general surveying process as other instruments: data is collected in the field, adjusted to the appropriate coordinate system, and relevant features can be extracted to produce deliverables ranging from topographic maps, coordinate values, 2D or 3D CAD drawings etc.

Key words: 3D Laser Scanning, Cultural Heritage, damage building.

INTRODUCTION

Years ago, the measurement of any object was exclusively done with theodolites or total stations. With the increasing usage of 3D CAD design tools the need for better, more accurate and faster 3D measurement grew in parallel. 3D Laser Scanning describes a method where a surface is sampled or scanned using laser technology. The word LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. The first working laser was demonstrated in May 1960 by Theodore Maiman at Hughes Research Laboratories [7]. The data collected through laser scanning can be used to construct digital, two-dimensional drawings or three-dimensional models useful for a wide variety of applications. In the early stages, laser scanning was short range and mainly used in the automotive and industrial design process to facilitate the Computer Aided Design (CAD) process. Mid-range scanners were developed for the petrochemical industry. Due to the complexity of plants, which were only documented as 2D drawings. However the key to success in using 3D laser scanning remains the setup and implementation of the right methodology and workflow "fit for the job", combined with the selection of the most appropriate hardware and software. According to the laser scanning users' community, the survey planning should at least contain the following topics:

-Determining the goals and objectives;
-Analysing the area to be surveyed;
-Determining the measuring techniques and equipment;
-Data management.

Surveying with a 3D laser scanner generates a new set of information – the point cloud. A point cloud can be compared with photogrammetry in that it is derived from a remote sensing instrument, that is, the measurements are taken without physically contacting the target area. Lastly, a comparison can also be made to remote sensing satellites, as additional "non-positional" data is collected from the raw measurements, such as the signal intensity of each point in the cloud, which will vary based on the reflectivity of the scanned object. Each point in the point cloud is measured with respect to the scanner position, and similar to photogrammetry, the position of the scanner (the camera) does not need to be known during the measurements. Aligning the point cloud to local control with laser scanning

is similar to photogrammetric control, as overlapping targets can be used to join multiple scans (photos) together and to "fit" it to the desired coordinate system. The survey preparation phase includes the decision making on the registration technique to be used. These techniques can be subdivided into three categories: registration using 3D re-sectioning of scanned targets, registration by setting the laser scanner over known control points, and registering using cloud to cloud constraints [8]

The recording of position, dimensions and/or shape is a necessary part of almost every project related to the conservation of cultural heritage, forming an important element of the documentation and analysis process. For example, knowing the size and shape of a topographic feature located in a historic landscape can help archaeologists identify its significance; knowing how quickly a stone carving is eroding helps a conservator to determine the appropriate action for its protection; while simply having access to a clear and accurate record of a building façade helps a project manager to schedule the work for its.[1]

MATERIALS AND METHODS

At present there is no standard procedure for survey planning for terrestrial laser scanning. To collect data used in our example we used a LeicaScanStation2.
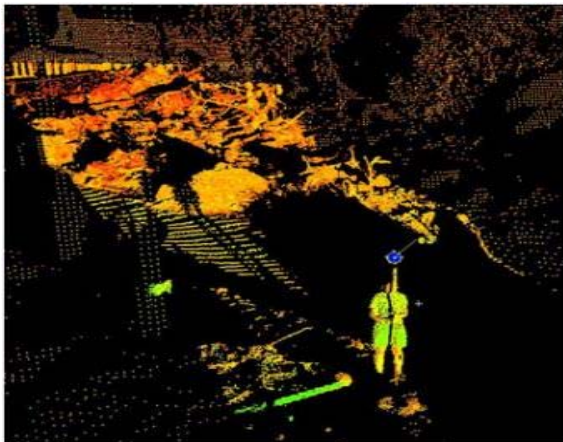
Figure 1. Reflective target setup over common points used to link neighboring scans

Before starting the scanning, the scanning device itself was connected to a laptop that can receive and store all the points coming from the

scanner and control the properties of the scanner through LeicaHDS Cyclone software. This software provides the tools to automatically detect artificial targets in the scan (Figure1). Powerful yet affordable 3D point cloud visualisation (Figure2), measurement, mark up, and data exchange software for professionals.

Leica Cyclone BASIC provides professionals with a set of tools for efficiently managing and executing laser scanning/High Definition Surveying (HDS) projects.

Professionals can collect and analyse laser scan data, while collaborating for better informed project decisions. In the field, Cyclone BASIC operates time-of-flight and phase-based Leica Geosystems scanners. Users can manage scan parameters; scan target acquisition; field QA; digital imaging; geo-referencing; and more depending on scanner capabilities.

In the office, Cyclone BASIC provides viewing and navigating of point clouds and 3D models, as well as measurement and mark-up/redlining. Cyclone BASIC is a versatile "back-office „data-exchange module, supporting imports and exports of a wide range of formats.[5]
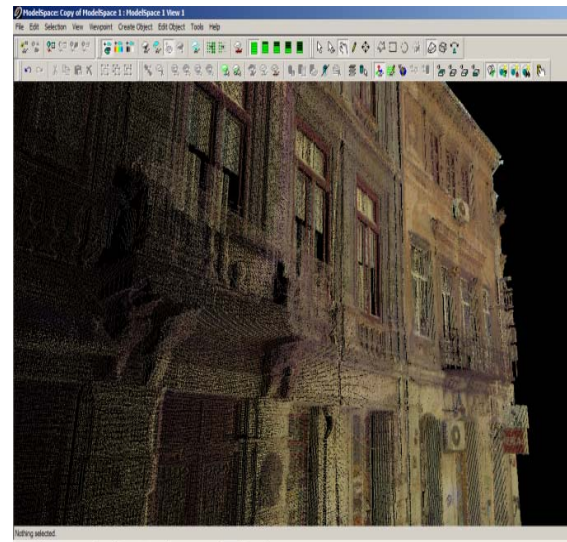

Figure 2. A damage balcony on a building located on French Street, Bucharest (seen on Cyclone software)

Figure 3. Leica Scan Station 2

The Leica Scan Station (Figure 3) 2 is a pulsed type, laser Class 3R, laser scanning system that has a modelled surface precision (noise) of 2 mm, an scan resolution of 6 mm (Gaussian - based) for position and 4 mm (FWHH - based) for distance at a range of 0m-50 m, the maximum range being 300 m at 90% (134 m at 18%) and a maximum instantaneous scan rate up to 50.000 points/sec. The maximum field-of-view (per scan)of the scanner is 360° horizontal and 270° vertical and has an optical sighting using the Quick Scan™ button.

Laser scanning from any platform generates a point cloud (Figure 4): a collection of XYZ co-ordinates in a common co-ordinate system that portrays to the viewer an understanding of the spatial distribution of a subject. For most laser scanning instruments, the point cloud can be regarded as the 'raw product' of a survey. The point cloud may also include additional information, such as return intensity or even colour values. Generally, a point cloud contains a relatively large number of co-ordinates in comparison with the volume the cloud occupies, rather than a few widely distributed points.[9]
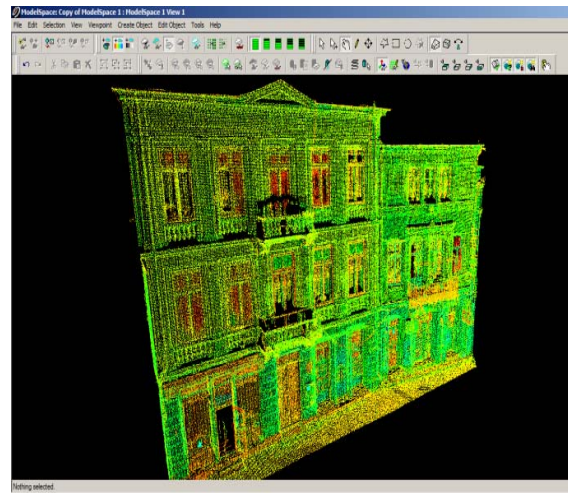
Figure 4. Points cloud representing the façade of the building located in Old Centre, Bucharest

Laser scanning might have a use at any stage of a project. Tasks that might be considered as potentially suitable for the application of laser scanning could include any of the following:

• contributing to a record before renovation of a subject or site, which would help in the design process as well as contribute to the archive record;

•　contributing to a detailed record where a feature, structure or site might be lost or changed forever, such as in an archaeological excavation or for at a site at risk; (Figure 5)

Figure 5. Laser scanning for historic sites at risk, St Mary's Church Whitby, North Yorkshire.

•　structural or condition monitoring, such as looking at how the surface of an object changes over time in response to weather, pollution or vandalism;

•　providing a digital geometric model of an object from which a replica can be generated for display, or as a replacement in a restoration scheme; (Figure 6)

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Figure 6. An original and replica bust of the Emperor Caligula generated from data collected by air triangulation laser scanner (courtesy of Conservation Technologies, National Museums Liverpool)

• contributing to three-dimensional models, animations and illustrations for presentation in visitor centres, museums, through the internet and through the media (enhancing accessibility/ engagement and helping to improve understanding);
• aiding the interpretation of archaeological features and their relationship across a landscape, this contributing to understanding about the development of a site and its significat change to the area;
• working, at a variety of scales, to uncover previously unnoticed archaeologically significant features – such as tool marks on an artefact – or looking at a landscape covered in vegetation or woodland
• spatial analysis, not possible without three-dimensional data, such as line of sight or exaggeration of elevation. [3]

It is important to recognise, however, that laser scanning is unlikely to be used in isolation to perform these tasks. It is highly recommended that photography should also be collected to provide a narrative record of the subject. In addition, on-site drawings, existing mapping and other survey measurements might also be required to aid interpretation and understanding.

RESULTS AND DISCUSSIONS

It is unlikely that professionals in the heritage sector who require laser scanning data or products will themselves have the means or expertise to undertake the work. It is more likely that survey work will need to be commissioned and undertaken by a specialist contractor. The following tips will help when preparing to commission a survey.

• Consider the level of detail required and the extent of the subject. These are often the overriding parameters used to determine the appropriate survey technique and/or deliverable product.
• Start by working out what data are needed in order to answer the questions you have set. Try to come up with requirements for accuracy and products. It may not be necessary to specify the actual technique to be used, just the required products.
• Before you commission and procure the data, consider how you will use the product; additional costs might be hidden in buying new software/hardware.
• Discuss the requirements with possible contractors. A good contractor will be able to advise you if your requirements are achievable, realistic and necessary, as well as provide information on an alternative deliverable product that you may not have considered. Also discuss the work with other members of your organisation, especially with those with relevant expertise, as other uses for the survey data and products may be apparent to them, and may increase the overall value of the work to be commissioned.
• Consider how the collected survey will be archived and made available for use in the future. Take advice from national organisations such as the National Cultural Heritage.Determine who will own the collected data and the delivered product.
• Finally, prepare a project brief, using a standard document as a base, such as that published by English Heritage (eg Andrews, *et al* 2009 *Metric Survey Specifications for Cultural Heritage*). [2]

Asking the following questions will help you to better understand what your requirements are

and whether laser scanning, in its various forms, is suitable. It will also help to identify possible alternatives.

What outputs are wanted?
Scanning can contribute to a whole range of outputs, so deciding what outputs you require will help to determine an appropriate project brief. Outputs might include a highly edited surface mesh, two-dimensional drawings, rendered movies or even virtual environments. Other forms of data, such as images and survey control, are likely to be required to contribute to these outputs.
The scale of your output is a key decision, which will help determine the accuracy of the product and the required point density.[4]

What level of accuracy is required?
This is typically related to object size and the purpose of the survey. A common answer is 'the best that you can do', but this is not always helpful in deciding what type of technique should be used. It is perhaps more correct to ask what is the optimum accuracy that balances the needs of the task, the capability of the technique and the budget available

Time and access restrictions?
Access and time might be unlimited. For example, the object might be brought to a studio-based scanner. Alternatively, access to the subject may be easy, perhaps because temporary scaffolding is in place, but time may be restricted because the scaffolding will be dismantled, making future access impossible unless new scaffolding is erected. Note that while scanning from a static position requires a stable platform (Figure 7), scanning from scaffolding or from a mast or hydraulic platform is possible, although care should be taken to ensure that the scanner remains stable during operation .
Access might be restricted on health and safety grounds, because a building is unsafe, making a survey possible only from a few locations. In an archaeological excavation, survey may be time-critical, as recording is required at each part of the excavation and cannot be repeated. This requires scanning to be available on site during excavation.

Figure 7. Laser scanning from an extra tall tripod

Is three-dimensional information required?
If yes, consider how the information is going to be used. This will help you or the contractor to determine the processing that will be required on the laser scanning data. Even if the answer is no, and you only need two-dimensional measurements and dimensions, laser scanning may still be useful. Laser scanning can be used to provide line drawings in elevation, section, and plan. It is especially useful when access to a site makes it difficult to use conventional methods. The way in which laser scanning enables direct integration of the collected data on site can also help a contractor to reduce the likelihood of revisits.[6]

Budget
Although laser scanning is still generally regarded as a high-cost technique, it can be justified, as the information required may not be available in any other way. If the budget is limited, or non-existent, laser scanning probably is not a technique that you can use. Where it is adopted, it is advisable to try to ensure that it can be used in many different ways, so as to provide best value from its commissioning. A number of measured building survey contractors have found that laser scanning is a cost-effective route to

producing plans and elevations due to the reduced time on site as compared with conventional survey methods. For a large organisation the savings could fairly quickly compensate for the high initial capital outlay.

Can you do this yourself?
It may be possible to undertake the data collection and data processing yourself. However, scanning requires specialist skills in order to achieve a precise and reliable product. This might include techniques for providing precise survey control measurement and/or knowledge of 3D CAD or GIS software. If this is your first project, using a contractor is advisable.

CONCLUSIONS

With the developed visual laser scanner, the control software and the software for model generation,very powerful tools are available that are suitable for most cultural heritage surveying tasks. The developed laser scanner offers high accuracy measurements in conjunction with a high sampling rate and large dynamic range inreflective properties of object surfaces (highly reflective to absorbing). In combination with the DLR Panoramic Colour Camera a precise and accurate monitoring of the actual environment
by means of colour point clouds is
achieved. This is unique due to its high precision and quality.

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COMPARATIVE ANALYSIS OF ARC-TO-CHORD CORRECTIONS BETWEEN THE GAUSS-KRUGER PROJECTED SYSTEM AND THE STEREOGRAPHIC 1970 PROJECTED SYSTEM FOR THE SAME SIDE OF TRIANGULATION NETWORK

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Abstract

The study conducted in this paper regards the comparative analysis of arc-to-chord correction between the Gauss-Kruger projected system and the Stereographic 1970 projected system. The correction is due to the fact that the measured direction between two points is actually a curved line, on the surface on a body such as an ellipsoid, that passes through these points. When projected onto a plane, the geodetic direction looks like an arc not a straight line. The angle that we compute from field notes is defined by the difference between two measured directions. Thus, the computed angle differs from the plane angle that we have to use when working with the State Plane Coordinate System. On the basis of the simple relation between spherical excess and arc to chord correction, formulas to compute the arc to chord correction for different map projections can be derived. In essence, research team aims to highlight the arc-to-chord differences obtained comparing the two projected system taken in consideration.

Key words: arc-to-chord correction, Gauss-Kruger, spherical excess, Stereographic 1970, triangulation network

INTRODUCTION

Arc-to-chord correction become significant and they have to be determined for the IInd and IIIrd order networks, that's why we chosed points from the IIIrd order network of the Cluj county for the comparative study.

The directions reduction for the projection plan was realized for the Stereo 70 projection plan and also for Gauss Kruger.

The arc-to-chord correction- Stereo 70

Regarding the compute of arc-to-chord correction for Stereo 1970 projection plan, the operation is applied to azimuthal directions measured in the geodetic triangulation network and has to precede the rigorous compensation works. Each

direction reduced to the ellipsoid measured from "i" station to "j" point from geodetic network, will receive a δ_{ij} correction with the value depending by the visa lenght, by orientation and by its distance from the origin of the xOy system axes . (Munteanu, 2003)

Regarding the deduction of a compute formula, in the stereographic projection plan we considered the geodetic points: 1 (x1,y1) and 2(x2,y2). The geodetic line 1-2 which joins the points to the ellipsoid has a plane image and a curve, concaved to the origin of the xOy axes system. In its extremites, in 1 and 2 points, the curve makes with its chord (Fig.1) the δ12 and δ21 small angles,which represent the arc-to-chord corrections of the directions to the projection plan.
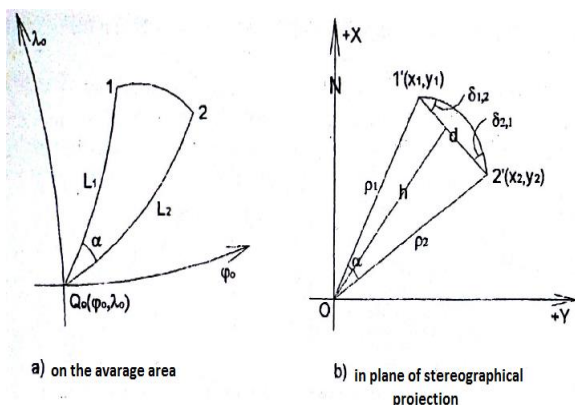
Figure 1. The Arc-to-chord correction for the Stereographical 1970 plan projection

The arc-to-chord corrections (δ_{12} and δ_{21}) represent the angles formed by the curved geodetic line with the chord which joins the end points of geodetic line. The plane image of the geodetic line is concaved towards the projection pole, which also represent the origin of the coordinates axes system. The arc-to-chord angles are positive when the passing from the curved line to chord is clockwise, and are negative when the passing is counter clockwise. (Moldoveanu, 2004).

Arc-to-chord corrections- Gauss Kruger

The geodetic lines from the ellipsoid, particulary the geodetic triangle sides from the ellipsoid are represented in the Gauss projection generally by curves with concavity to the axial meridian. In the two extreme points of geodetic line, the curve and its chord makes each one a small angle δ_{12} and δ_{21} (Fig. 2), representing the arc-to-chord corrections, for the Gauss projection plan.
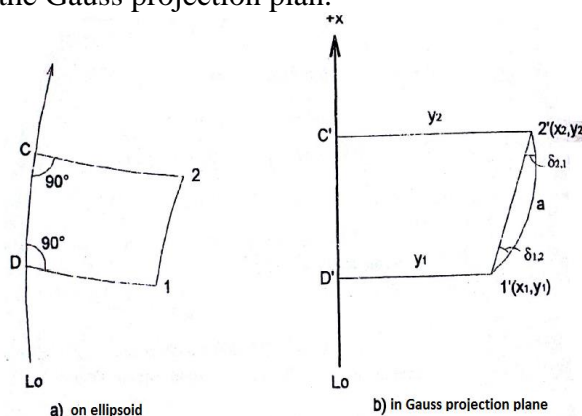
Figure 2. The Arc-to-chord correction for the Gauss - Kruger plan projection

If the asimutal surveys realized in the geodetic triangulation network have to be performed in the Gauss projection plan, then the surveyed asimutal directions have to be reduced to the plan of this projection system,
applying to each direction one correction compute with the specificy formulas of projection. (Palamariu et al., 2002)
The computed formulas for the reduction of directions to the Gauss projection plan are
different from a geodetic triangulation order to another, according to the neccesary precision.
For the IIIrd order networks, we consider the $1`(x1,y1)$ and $2`(x2,y2)$ points – the plane images of the points 1 and 2 from ellipsoid, and the curve 1'a2' – the plane image of the respective geodetic line. The C' and D' points are the perpendicular lines from 1' and 2' on the Ox axis. The δ_{12} and δ_{21} angles represent the reduction corrections of the directions to the gauss projection plan. (Ortelecan, 2006).

MATERIALS AND METHODS

In determining the arc-to-chord corrections were used formulas related to the spherical excess and other items that will be presented below.
Because the projection of the line, sum of the angles of the plane figure is equal to the sum of the angles corresponding to the ellipsoid (sphere of average radius). So we can write:

$$200^g+\left|\delta_{12}\right|+\left|\delta_{21}\right| = 200^g+\varepsilon$$
$$200^g+2\delta = 200^g+\varepsilon$$

CASE STEREO(1)

$$400^g+\left|\delta_{12}\right|+\left|\delta_{21}\right| = 400^g+\varepsilon$$
$$400^g+2\delta = 400^g+\varepsilon$$

CASE GAUSS (2)

(1) In the absolute value (δ), the correction is equal to half of ε spherical excess of the triangle formed by the station point, the target point and pole projection Q0

$$2\delta = \varepsilon$$

$$\delta = \frac{\varepsilon}{2}$$

$$\varepsilon^{cc} = \rho^{cc}\frac{S}{R^2},$$

where: ε - spherical excess
S – spherical triangle area
R – radius of the sphere

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ρ – conversion factor from radians to seconds

The area of the triangle is determined by the determinant that contains the coordinates of the triangle tops and unity. The spherical triangle area can be assimilated with the plan triangle area. (Ortelecan, 2006)

.

$$S_1 = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ 0 & 0 & 1 \end{vmatrix} = \frac{1}{2}\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix} = \frac{1}{2}(x_1 \times y_2 - x_2 \times y_1)$$

Based on formulas (area, avarage radius) we can obtain the arc-to-chord corrections formula:

$$\delta = \frac{\rho^{cc}}{4R^2} \times \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ 0 & 0 & 1 \end{vmatrix}$$

(2) For the spferical excess is well known the general formula:

$$\varepsilon^{cc} = \rho^{cc}\frac{S}{R^2},$$

where:

S- quadrilateral 12CD area on the ellipsoid

R is the average radius of curvature of the ellipsoid in the quadrilateral portion considered.

Since the spherical excess is relatively small, the compute of S area on the ellipsoid can replace the trapeze area S 'Plan 1' 2 `C` D `.

Arc-to-chord values are deteminated with the following formula:

$$\left|\delta_{12}^{cc}\right| = \left|\delta_{21}^{cc}\right| = \frac{1}{2}\varepsilon^{cc} = \frac{\rho^{cc}}{2R^2} \times \frac{(y1+y2)}{2} \times (x2-x1)$$

Direction determination was done using Zeiss Theo 010 (Fig. 3).
Tachymeter-theodolite Zeiss Theo 010 is a precision theodolite, recommended for all kind of geodetic-topographic projects that admits a mean square error of $\pm 4^{cc}$ ($1,5^{cc}$), for a single measured direction in both telescope positions. Main usages are: triangulations on IInd, IIIrd and IVth grades, precision pollinations done day or night, tracing constructions. For horizontal and vertical circle readings, it is used an microscope with optical micrometer with coincidence and reading is done using an optical device.

Figure 3. Tachymeter-theodolite Zeiss Theo 010

RESULTS AND DISCUSSIONS

The case study on the design of azimuthal directions in Stereo 70 projection plane was performed in three points corresponding to triangulation network of Cluj-Napoca. The following points were studied: Dl.Hoia, La Pipa, Dl.Sopor (Figure 2). The coordinates of points in the Stereo 70 projection plane are presented in Table 1. They were reduced to the projection plane - Table 2.

Table 1. Stereo 1970 Coordinates

Point	X	Y
Dl. Hoia (47)	586465.38	388398.37
La Pipa (42)	590814.83	398776.73
Dl. Sopor (48)	584577.58	397156.93

Table 2. Stereo 1970 Coordinates - Coordinates with origin in projection pole

Point	X	Y
Dl. Hoia (47)	86465.38	-111602
La Pipa (42)	90814.83	-101223
Dl. Sopor (48)	84577.58	-102843

To determine the corrections of arc-to-chord reductions for Gauss-Kruger system it was necessary to transform the Stereo 1970 coordinates to Gauss-Kruger coordinates.
First of all, it was realised the transformation of Stereo coordinates to geographical coordinates. This was done in two steps:
- Step 1 is the transformation of geographical coordinates of secant plane to tangent plane: scale is changed by multiplying with "c"

coeficient, which is named reversion to normal scale factor
- Step 2 represents the transformation of stereographic coordinates of tangent plane to geographical coordinates B, L of Krasovski 1940 ellipsoid. It is solved using formulas with constant coeficients.
Obtained values are presented in Table 3.

Table 3. Geographical Coordinates

Point	B	L
47	46.1006	23.3222
42	46.4833	23.4025
48	46.451	23.3916

Next the geographical coordinates were transformed into Gauss - Kruger coordinates.
Knowing the geographical coordinates of a point of the rotation ellipsoid (B, L), the x and y plane Gauss - Kruger coordinates of that point were calculated.
The method of constant coefficients was applied, and then Gauss coordinates of that three points were obtained.- Table 4.

Table 4. Gauss-Kruger Coordinates

Punct	x	y
47	5184721.209	4693965.312
42	5189592.408	4704110.736
48	5183280.051	4702809.416

Next, the compute of the of arc-to-chord corrections in Stereo projection plane and in Gauss-Kruger plane was done.

Reduction of azimuthal directions to Stereo projection plan

The compute of the arc-to-chord corrections, as well as compute of liniar deformation modulus was realised using the coordinates of that points that have the origin in projection pole.
Based on the presented formulas we determined the of arc-to-chord corrections for measured directions.
Control practical rule:

In every geodetic triangle, the arc-to-chord correction sum to the projection plan for those three angles have to be equal with the value of spherical excess for the respective triangle took with changed sign.In the figure 5 we can

The arrangement of the three points that were studied in the geodetic triangulation network of Cluj county is presented in Figure 4.
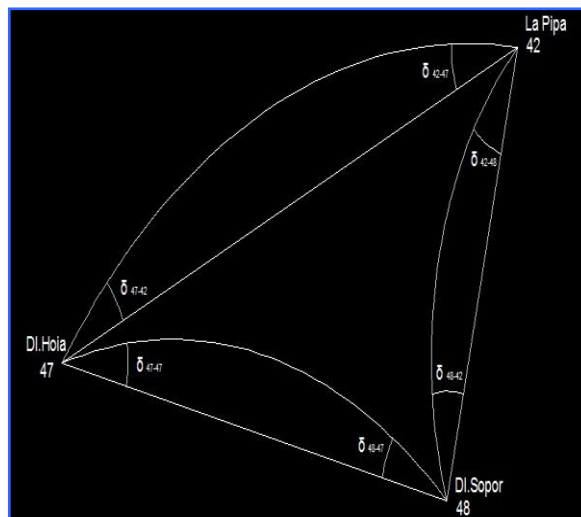

Figure 4. Analised geodetic triangle

Using the area of the plane triangle we determine the value of sferical excess on triangle.

$$\varepsilon = \frac{636620}{2\cdot 6378957^2}\cdot \begin{vmatrix} 86465.38 & -111601.63 & 1 \\ 90814.83 & -101223.27 & 1 \\ 84577.58 & -102843.07 & 1 \end{vmatrix} = 0,451264$$

Values of arc-to-chord corrections are presented in Table 5.

Table 5. Values of arc-to-chord corrections

Name of correction	Value of correction
$\delta_{47\text{-}42}$	5.40844373
$\delta_{42\text{-}47}$	-5.4084437
$\delta_{47\text{-}48}$	2.13803557
$\delta_{48\text{-}47}$	-2.1380356
$\delta_{48\text{-}42}$	3.04477637
$\delta_{42\text{-}48}$	-3.0447764

observe the β_1, β_2 and β_3 angles equals with those three angles from the ellipsoid.
$\beta_1 + \beta_2 + \beta_3 = 200^g + \varepsilon$
$\beta_1`$, $\beta_2`$ si $\beta_3`$ angles, between the sides which joins the triangle's tops are reduced to the projection plan. (Ortelecan, 2006)

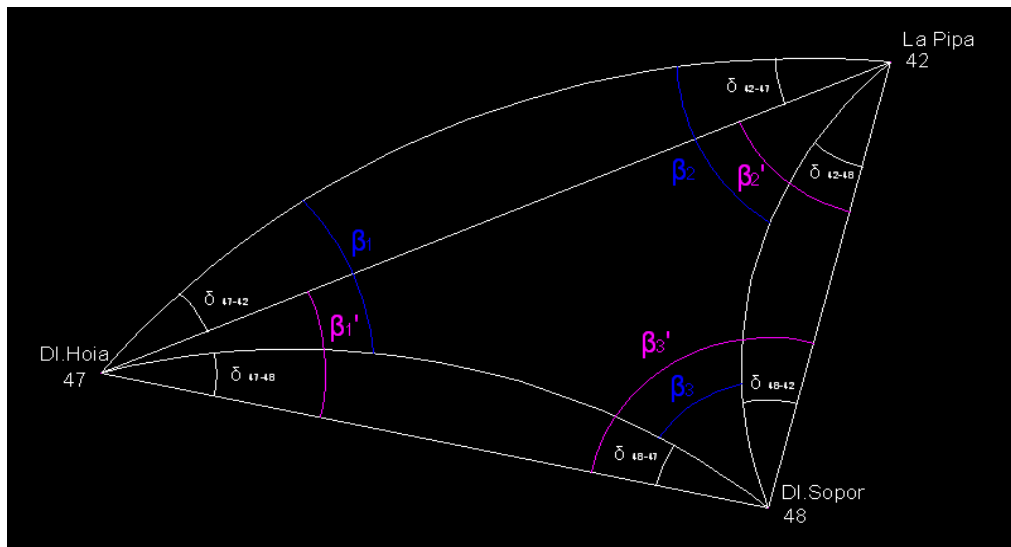$$\beta_1' + \beta_2' + \beta_3' = 200^g + \varepsilon$$

Figure 5. The control of arc-to-chord corrections to the projection plan

We note α_m = the measured direction, α_r = the reduced direction at the projection plan and δ = the reducing correction at the projection plan, generaly it can be write like this:

$$(\alpha_r)_{ij} = (\alpha_m)_{ij} + \delta_{ij}$$

Apllying the relation for all the triangle's tops, considered, like stations, we obtain:

$$\beta_1' = \beta_1 + (\delta_{47-48} - \delta_{47-42})$$
$$\beta_2' = \beta_2 + (\delta_{42-48} - \delta_{42-47})$$
$$\beta_3' = \beta_3 + (\delta_{48-42} - \delta_{48-47})$$

By the direction coefficient difference it has been established the angular corrections for the reducing in the projection plan.(Table 6) :

Table 6. Angular correction

Angular corrections	Value
$\delta_{47-48} - \delta_{47-42}$	-3.27041
$\delta_{48-42} - \delta_{48-47}$	5.182812
$\delta_{42-47} - \delta_{42-48}$	-2.36367
$[\ ] = \varepsilon^{cc}$	-0.45126

After all the efectuated computes, the truth of the affirmation mentionated above is confirmed.

Reduction of azimuthal directions to Gauss - Kruger projection plan

The area of the triangle is determined by the determinant that contains the Gauss coordinates of the triangle tops and unity.

det=	5184721.209	4693965.312	1
	5189592.408	4704110.736	1
	5183280.051	4702809.416	1

Applying the formula $\varepsilon^{cc} = \rho^{cc} \dfrac{S}{R^2}$, we obtain:

$\varepsilon^{cc} =$	0.4512981

The arc-to-chord reduction is performed taking into account the following principles:

1. Ordinate values will be reduced by canceling the meridian axial first digit indicating the time zone and by decreasing the amount of 500 000 000 m (table 7).

Table 7. Reduced Gauss-Kruger coordinates

Punct	x	y
47	5184721.209	193965.312
42	5189592.408	204110.736
48	5183280.051	202809.4165

2. The numerical values of the abscissa and ordinate respectively environments are introduced in formula in meters with 3 decimal digits.

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3. The numerical values of arc-to-chord corrections are expressed in third order geodetic points with two decimal places given the precision of determination of ± 0 "1.

4. The numerical values of the corrections calculated in terms of reducing directions both ways positive or negative depending on the difference of the abscissae.

The arc-to-chord corrections values obtain for Gauss - Kruger projection plan are presented in Table 8.

Table 8. Values of arc-to-chord corrections

Name of correction	Value of correction
δ_{47-42}	-7.583907202
δ_{42-47}	7.583907202
δ_{47-48}	2.236394689
δ_{48-47}	-2.236394689
δ_{48-42}	-10.04555764
δ_{42-48}	10.04555764

CONCLUSIONS

The arc-to-chord corrections precede the offset angle triangulation networks, given the fact that by applying these corrections spherical excess is eliminate.

After the calculations for the two projection systems we notice higher values of arc-to-chord corrections for Gauss - Kruger system.

Arc-to-chord corrections size is influenced by the length of the chord visa, the distance from the pole projection and orientation visa.

Values of arc-to-chord corections become significant discount to be applied to the order triangulation networks III, II, I.

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3D MODELLING. VIRTUAL CAMPUS FOR THE UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE OF BUCHAREST

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Abstract

This paper presents the workflow for creating a virtual campus for the University of Agronomic Sciences and Veterinary Medicine of Bucharest from 2D GIS data. Basically, it follows the data integration based on ESRI templates and software specialised in 3D modelling. Over the years, GIS has evolved from a complex system for maintaining and analysing spatial and thematic information on spatial objects to digital representations of the Earth's surface and related objects belonging to urban areas. Thus, the most common use of 3D geovisualisation today, is within public planning, architecture, environmental monitoring and landscape planning.

Key words: GIS, 3D modelling, 2D data, virtual campus.

INTRODUCTION

The University of Agronomic Sciences and Veterinary Medicine of Bucharest is a modern educational institution that hosts all forms of high education. The quality of education provided in the lecture rooms, laboratories and faculty practice centres, is a certificate for the fact that USAMVB is the most representative and prestigious institution in agronomic and veterinary education in Romania. Many of its graduates become outstanding personalities in the fields of agricultural practice and in the teaching, research and administration fields. With a material base and an exceptional heritage which comprises two campuses – "Agronomy - Herăstrău "Campus and "Veterinary Medicine - Cotroceni "Campus, USAMV is a modern educational institution, in line with the European requirements. USAMVB has three subsidiaries acting as genuine research centres, production and practice - The Research and Development

Wine-growing "Pietroasa", Farm Fruit Growing "Istriţa" and teaching farm "Moara Domneasca".

This paper focuses on campus "Agronomie-Herastrau" (fig.1).

In the campus "Agronomie-Herăstrău" of an area of 38 hectares, located near the famous park in Bucharest, are six of the seven faculties of Veterinary Medicine Bucharest. In new dorms, live over 4,000 students who applied for accommodation at the beginning of the academic year. In the complex are also a cafeteria, two restaurants, three conference rooms and a summer terrace. Inside the campus students can also access a campus library with an impressive collection of books, including works of heritage. The studying conditions are great. In the campus can also be found a student church were religious services are performed as well as educational activities regarding young people. The sports area is composed of a multi-purpose olympic size gym, a grass football field, a synthetic football field, a tennis court. On campus are organised

sports competitions, cultural and artistic performances.

In this context, a smart campus provides an interactive map, as well as services that allow visualization, allow people to search, locate and access information about campus street network, buildings, classrooms, departments, study programs, offices, cafeterias, residence , green space, etc. Basically, it is a smart solution to provide bases for students' life improvement and better management of the resources related to the campus.

Figure 1. The study area-Agronomie-Herastrau Campus

MATERIALS AND METHODS

Nowadays, everyone is familiar with 3D visualization. A revealing example to support this idea is browsing or using Google Maps or Google Earth to identify the location of an object or event. It goes without saying that we better understand information when it is presented to us in a realistic, intuitive 3D form. Therefore I think it is a good approach for presenting the campus in terms of communicating ideas and fresh vision .The improve of aerial and close range photogrammetry, are important factors for the development of 3d modelling as well as the development of hardware components: processors, memory and disk space devices are now built to support and process large data sets, especially graphics cards that were previously used priory in the gaming industry. (S.C. Antules, 2013). Following this direction applications were developed and the most popular, comprehensive and intuitive are those developed by ESRI-ArcGIS 3D Analyst that includes ArcGlobe, ArcScene, and the complex CityEngine along with specific tools for 3D processing data. As mentioned in the abstract, this paper focuses on the integration of information using multiple applications, showing the interoperability of methods in

order to obtain realistic 3D visualization of Agronomie-Herestrau Campus.

In this sense I started from the Esri campus template in Redlands California that I downloaded from www.arcgis.com and wich I used as database support for the next actions (fig.2). In the first phase of the project I used a campus aerial image using the ANCPI portal to which I logged directly through the ArcMap GIS Server service in ArcCatalog menu.
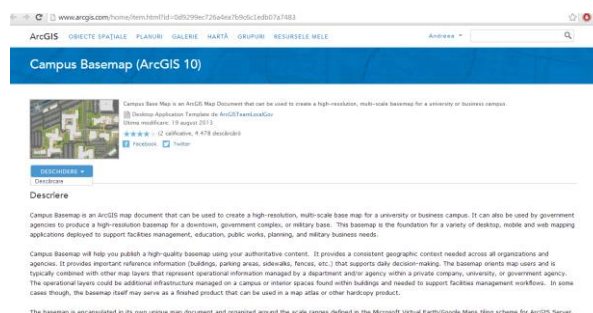
Figure 2. ESRI Campus Basemap

Having the support for the digitization I populated the geodatabase with the street network, buildings footprints, green spaces and other detail elements such as street furniture using the editing tools that are provided by the application. Regarding the tree layer, I populated it using "Collector" app available in AppStore for mobile devices using an organization account (Figure 3).
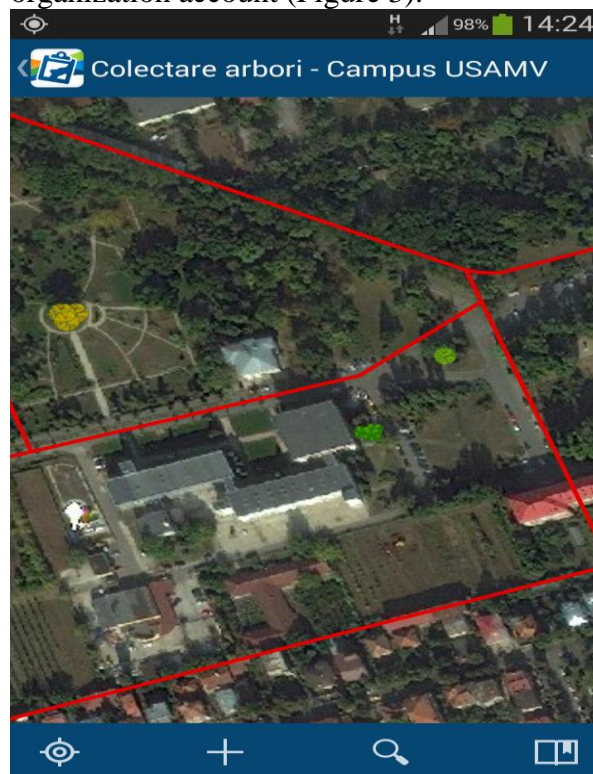

Figure 3. Collector App

After collecting the trees in the field, information about the type of trees and their location can be downloaded directly in ArcMap after logging into the same account as mentioned above. Apart from issues related to the campus as a whole, I rebuilt a part of the building FIFIM C body, by using building plans for the ground and the 2 floors. Also, I populated the attribute table with information about rooms, offices, classrooms, etc. especially those related to size - wall height-an important attribute when making transitions to 3D. For instance, in CityEngine, on the basis of a programming language, the walls can be extruded on the height attribute.

The described operations are the steps through which I created the data in the classic 2D GIS format (fig.6). After this stage we can discuss about 3D integration. Next are several available options. At first I chose ArcScene because I was familiar with the application. I loaded the data reported previously as being created and the digital elevation model of the terrain (fig.7). For the extrusion of the buildings are also several possibilities. They can be extruded considering height, depending on the number of floors or created in dedicated programs and then imported back into ArcScene. I chose the second option and used the trial version of Sketchup8. Before I started creating the actual buildings, I needed the textures. It reminded me of the open source Google Buildings app which unfortunately has been removed from the market in June past year. However, buildings that were constructed by using Google Buildings are still available for download at https://3dwarehouse.sketchup.com.

Figure 4. 3D model of the Horticulture Building from https://3dwarehouse.sketchup.com

After searching, I found several campus buildings in 3D format that I could download along with textures (Figures 4, 5).

Before I could use them in ArcScene, I had to convert them into a file that could be read by the software. In order to exchange data between 3D software the files must be converted to Collada (.dae). COLLADA ™ defines XML - based schema year to make it easy to transport 3D assets between applications - Enabling diverse 3D authoring and content processing tools to be combined into a production pipeline. The intermediate language provides comprehensive encoding of visual scenes including: geometry, shades and effects, physics, animation, kinematics, making and even multiple version representations of the same asset (www.collada.com).

However, if no buildings are available for download, they can be easily created in Sketchup using the building footprint or the buildings' plan together with pictures of them that can be used as textures.
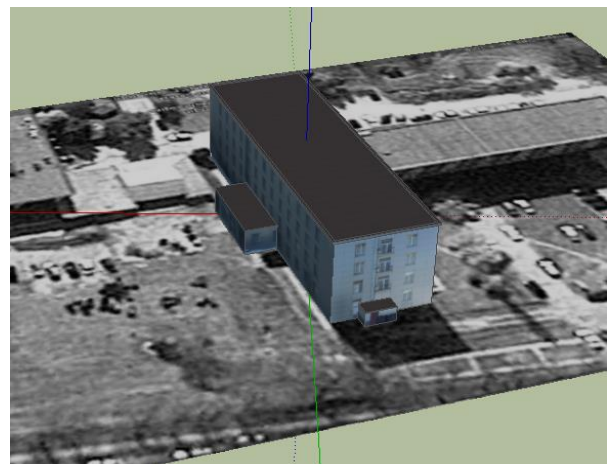

Figure 5. 3D model of the A4 Dorm from https://3dwarehouse.sketchup.com

A second method to transform 2D data that we created in 3D is to import the data in Esri CityEngine. In this case, the best way to import them is the form of. gdb basically import all data at once. The data is viewed sin eparate layers and can be approached individual to make changes and implement rules. In fact, the data is converted into 3D based on the processing rules (fig.8). CityEngine is complex by allowing mapping, compilation, analysis, geodatabase management and geographic information sharing. The software allows the

user to create high quality 3D content on 2D base date, attributes, and procedurally defined rules.

RESULTS AND DISCUSSIONS

I shown how the data originally created in 2D can be converted into 3D and can be combined with other data acquired from other sources using the different software mentioned. ArcScene is a more simplistic approach in comparison with Esri CityEngine but the results obtained in the last mentioned are more sophisticated, given the complexity of the program and knowledge needed to work with it.

In the end, what matters is the result and the impact a 3D model of the campus has, a realistic approach that can help decision makers in terms organizing, resource management, monitoring, and security.

Figure 6. 2D Agronomie-Herastrau Campus
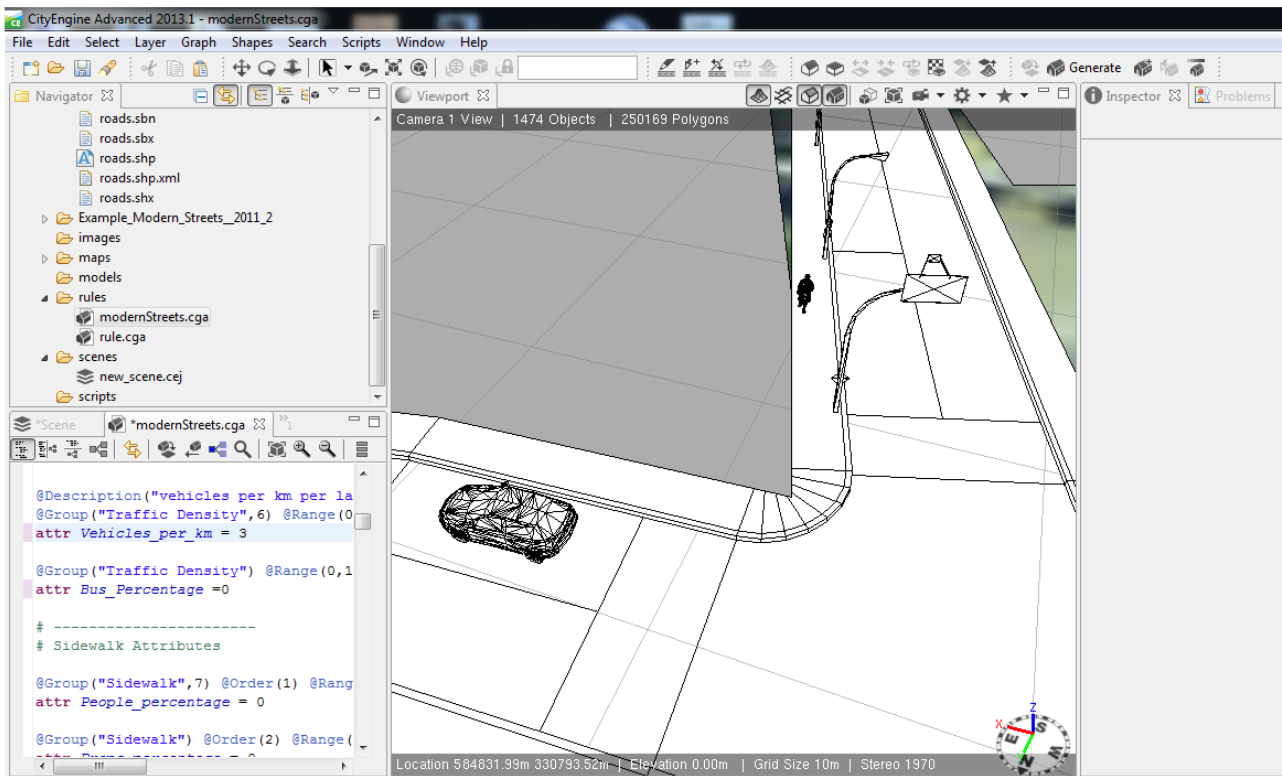
Figure 7. CityEngine modelling

Figure 8. ArcScene 3D Model of the USAMVB Campus

CONCLUSIONS

Why 3D? Because we live in a three dimensional world. Geographical Information Systems are a concept tool for capturing, storing, manipulating and analysing geographic data (D. Mihai, 2012), but manipulating and representing the world in 2D is no longer adequate because new applications demand higher complex hierarchical spatial data than previously supported by the relational model. In geomatics or geoinformatics, it is considered that real world objects exist in three-dimensional, thus it is desirable to have a system which is able to store, handle and analyse objects in a 3D environment. The paper focuses on that few systems available on the market which can be categorized as solutions

for 3D representations and analysis. The 3D USAMVB Campus is an example of how this systems can work together in obtaining a realistic visualization (A. Abdul-Rahman, 2007).

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www.Collada.com

https://3dwarehouse.sketchup.com

ESTIMATING THE GNSS BROADCAST EPHEMERIS ERROR

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Abstract

The aim of this paper is to compare the position of a certain GNSS satellite with respect to an ECEF (Earth Centered Earth Fixed) frame, obtained from broadcast ephemeris and precise post-processed orbits. To accomplish this, RINEX (Reciever Independent Exchange Format) and SP3 (Standard Product) files were downloaded from the International GNSS Service (IGS) corresponding to the same day.
Furthermore, in order to assess the error of the broadcast ephemeris, several routines were developed under MATLAB environment, with the aim of importing the data, comparing the orbits and plotting the results.

Key words: GNSS, precise orbits, ephemerides.

INTRODUCTION

Satellite PNT (positioning, navigation and timing) was born during the XX_{th} century. At the beginning, GNSS (Global Navigation Satellite Systems) were developed for military purposes, but now have various uses for the civil segment. Domains such as aerial, naval and terrestrial navigation benefited the most becoming dependent because of the efficient solutions that the satellite technology provides.
To obtain the right position and find the solution for the navigation problem is mandatory to know (with certain accuracty) the position of the GNSS satellites which may be obtained with the aid of the broadcasted ephemeris and the clock corrections transmitted by the system. These data is part of the navigation message. Any error in the GNSS satellites coordinates or satellite clock will affect the positioning accuracy.

COMPUTING THE SATELLITE ORBIT

To compute a GNSS satellite orbit or position at a certain moment with respect to an ECEF frame, the data from a RINEX (Reciever INdependent EXchange format) navigation file (baia0710.13n) has been used (Figure 1).


```
1 13 03 11 20 00  0.0 6.680842489004D-06 2.955857780762D-12 0.000000000000D+00
   8.700000000000D+01-3.934375000000D+01 4.114457219373D-09 2.019860600490D+00
  -1.996755599976D-06 1.641191076487D-03 1.329556107521D-05 5.153715318680D+03
   1.584000000000D+05-2.421438694000D-08-8.571340308443D-02-2.421438694000D-08
   9.607402942553D-01 1.195625000000D+02 3.658472115763D-01-7.852112737794D-09
  -8.357491088073D-11 1.000000000000D+00 1.731000000000D+03 0.000000000000D+00
   2.000000000000D+00 0.000000000000D+00 8.381903171539D-09 8.700000000000D+01
   1.511400000000D+05 0.000000000000D+00
```

Figure 1. RINEX data block for satellite 1

The data blocks of the RINEX file have the required parameters that define an orbit:
a) Keplerian parameters (Figure 2)
- $\sqrt{a}$ – square root of the semi-major axis;
- e – orbit eccentricity;
- i_0 – initial inclination;
- M_0 – mean anomaly;
- Ω - longitude of ascending node ;
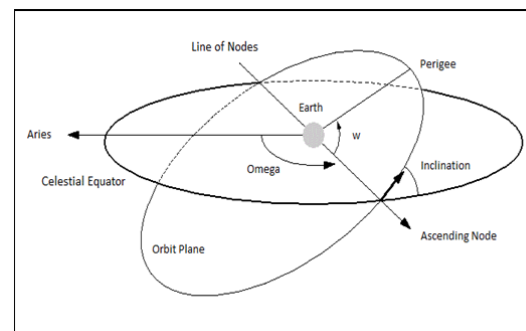- ω - argument of perigee.

Figure 2. Keplerian elements
(satelliteorbitdetermination.com)

b) Perturbation parameters
- Ω_{dot} – rate of change of right ascension;
- Δn – delta n;
- i_{dot} – rate of change of inclination;
- C_{uc}, C_{us}, C_{rc}, C_{rs}, C_{ic}, C_{is} – correction coefficients to the argument of perigee, orbit radius and inclination.

(http://spaceflight.nasa.gov/realdata/elements/)

To obtain the GNSS satellite coordinates from the navigation message the following algorithms must be respected :
- Compute the time t_k from the ephemerides reference epoch t_{oe}:
$$t_k = t - t_k$$
- Compute the mean anomaly at t_k:
$$M_k = M_0 + \left(\frac{\sqrt{\mu}}{\sqrt{a^3}} + \Delta n \right) t_k$$
  μ = gravitational constant
- Solve (iteratively) the eccentric anomaly
$$M_k = E_k - e \sin E_k$$
- Compute the true anomaly v_k:
$$v_k = \arctan\left(\frac{\sqrt{1 - e^2} \sin E_k}{\cos E_k - e} \right)$$
- Compute the argument of latitude u_k:
$$u_k = \omega + v_k + C_{uc}\cos 2(\omega + v_k) + C_{us}\sin 2(\omega + v_k)$$
- Compute the radial distance r_k:
$$r_k = a(1 - e\cos E_k) + C_{rc}\cos 2(\omega + v_k) + C_{rs}\sin 2(\omega + v_k)$$
- Compute the longitude of the ascending node λ_k:
$$\lambda_k = \Omega_0 + (\Omega_{dot} - \omega_E) t_k - \omega_E t_{oe}$$
  ω_E= earth's angular velocity
- Compute the coordinates in the ECEF frame:
$$\begin{bmatrix} X_k \\ Y_k \\ Z_k \end{bmatrix} = R_3(-\lambda_k)\, R_1(-i_k)\, R_3(-u_k) \begin{bmatrix} r_k \\ 0 \\ 0 \end{bmatrix}$$
  R_1 and R_3 are rotation matrices

After these steps, the results will be compared with corresponding data from the precise post-processed orbits contained in the SP3 (Standard Product) file (igs17312.sp3).

Furthermore, as the SP3 file provides satellite positions at a 15 minutes rate, for other epochs, an interpolation process is necesessary. A 10th order polynomial interpolation was used as this is sufficient to provide centimeter accuracy (Sanz Subirana & Juan Zornoza, 2013).

$$P_n(x) = \sum_{i=1}^{n} y_i \, \frac{\prod j \neq i \, (x - x_j)}{\prod j \neq i \, (x_i - x_j)}$$

ROUTINES DEVELOPED UNDER MATLAB

MATLAB is a high-level programming language for numerical computation, and visualization. Using this environment, tasks such as analyzing data, developing functions, plotting results, and many other applications are successfully completed (mathworks.com).

In order to accomplish the purpose of this paper, several functions, described below, were developed:
- readRINEXnav.m – imports the data from the RINEX navigation file (baia0710.13n) and it returns a matrix containing the broadcasted ephemerides.
- extr.m – it receives as input data, a matrix with broadcasted ephemerides, and the PRN number of the GNSS satellite for which the orbit will be computed. And it will return the ephemerides only for that satellite
- satdata.m – this function will compute the GNSS satellite orbit with respect to an ECEF frame
- plot_orbit.m – is an improved function which uses satdata.m Its inputs are: the matrix with extracted ephemerides, the period of interest (t_{oe1}, t_{oe2}- time of ephemeris) in seconds, and the increment.
- readSP3.m – which will return the ECEF coordinates in km (X, Y, Z) and the corresponding time in seconds of the current day for the GNSS satellite in cause from the SP3 file (igs17312.sp3)
- extract_sp3.m – will return the ECEF coordinates and corresponding time for a certain satellite.
- interpolare.m – the function will interpolate the track of the satellite in its orbit at a given time.

A general script, namely the s_orbit.m file, involving all the functions described above, computes and plots the orbit from the RINEX navigation file and from the SP3 file.

RESULTS AND DISCUSSIONS

The data files (RINEX and SP3) used to accomplish the purpose of this paper were downloaded from the International GNSS Service (http://igs.bkg.bund.de) corresponding to the same day (11.03.2013).
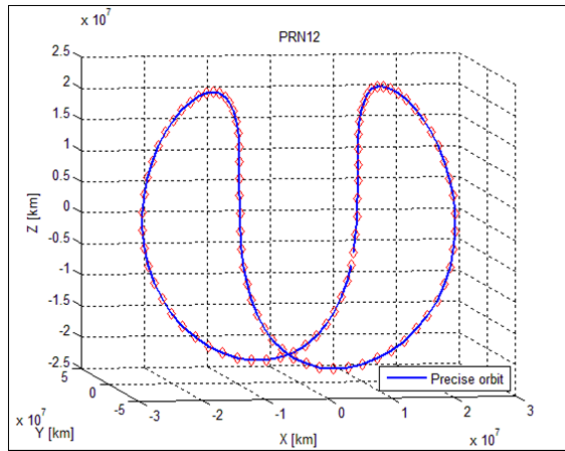As inputs, the GPS SV 12 broadcast ephemeris and post-processed orbits were used.

Figure 3. Complete precise orbit

The first result was the complete precise orbit of the satellite obtained from the SP3 file. Its position was computed every 15 minutes (Figure 3). This will be used as reference data and it will be compared with the positions obtained from the broadcast ephemeris.
The next phase involved the computation of the partial orbit from the navigation message with respect to ECEF frame according to the algorithm presented before. The GPS satellite position was calculated for 8 epochs, from t_{oe1}=252000 (seconds of GPS week) to t_{oe2}=258300, every 15 minutes (Table 1).

Table 1. ECEF coordinates of GPS satellite 12 at different epochs

| No. | t_{oe}(sec) | 1.0e+07* | | |
		X[km]	Y[km]	Z[km]
1	252000	1.1286	1.9896	1.3650
2	252900	1.1340	2.1322	1.1267
3	253800	1.1418	2.2466	0.8691
4	254700	1.1482	2.3315	0.5967
5	255600	1.1491	2.3863	0.3142
6	256500	1.1407	2.4111	0.0263
7	254700	1.1191	2.4074	-0.2620
8	258300	1.0811	2.3769	-0.5458

The plotted values describe the broadcasted partial orbit (Figure 4).
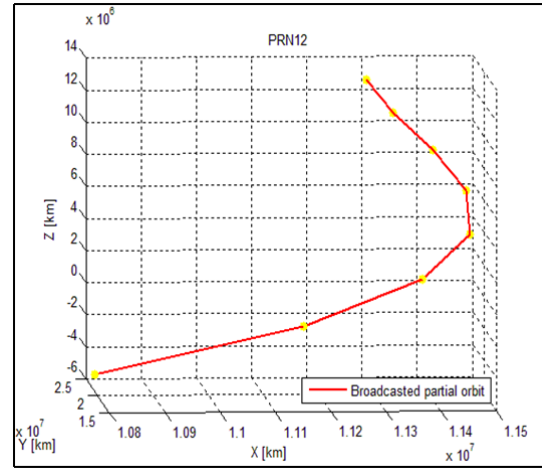
Figure 4. Broadcasted partial orbit

As we expected , the coordinates obtained from RINEX navigation message compared with those from SP3 file contain errors, which are presented in Table 2.

Table 2. Errors between RINEX-SP3

No.	t_{oe}(sec)	Δx[m]	Δy[m]	Δz[m]
1	252000	0.5190	-0.7292	0.5721
2	252900	0.4597	-0.5377	0.5169
3	253800	0.4168	-0.4159	0.4562
4	254700	0.3620	-0.3355	0.3818
5	255600	0.2644	-0.2653	0.2736
6	256500	0.1003	-0.1867	0.1086
7	254700	-0.1434	-0.0985	-0.1374
8	258300	-0.4617	-0.0276	-0.4804

For a better understanding the evolution of errors over time, the linear error have been computed (Table 3) and plotted (Figure 5).

Table 3. Spatial distance (RINEX vs SP3)

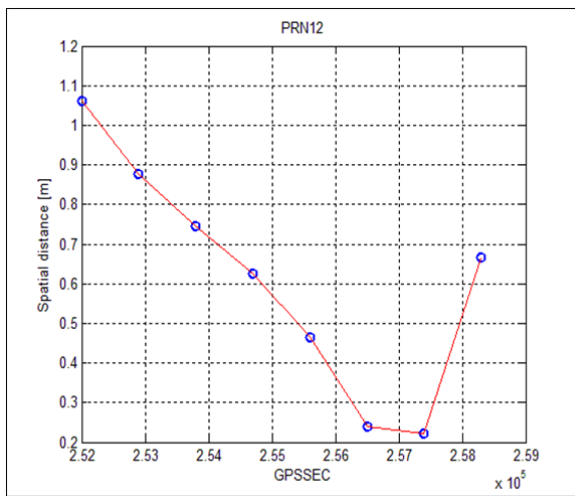| t_{oe} (sec)	Spatial dist. [m]
252000	1.0623
252900	0.8762
253800	0.7449
254700	0.6240
255600	0.4638
256500	0.2382
254700	0.2217
258300	0.6668

Figure 5. Linear error over time

Also, a comparison has been made between the precise orbit computed every 15 minutes and interpolated orbit computed every 5 seconds, both belonging to the same period of time (Figure 6).
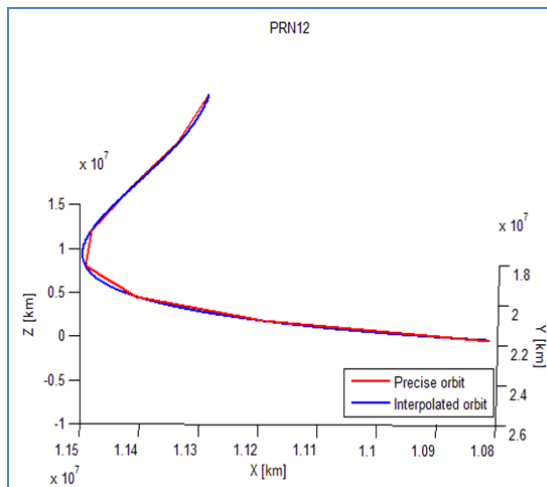

Figure 6. Precise orbit vs Interpolated orbit

CONCLUSIONS

Satellite based positioning and navigation are affected by various errors that occur during these processes. The differences between broadcasted and post-processed orbits are small enough for real time navigation and positioning. This represents the basic concept for GNSS measurements in real time.

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MASSIVE ASSESSMENT OF REAL ESTATES FOR TAX PURPOSES. CASE STUDY: CAINARII VECHI MAYORALTY, SOROCA DISTRICT

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Abstract

The current condition of the evaluation of the real estate's is analysed. The results of the application of the massive evaluation of the real estate's are described. The strengths and the weak points which appear by applying the massive evaluation of the real estate's are analysed. The application of a more advanced and correct appraisal of the value of real estate's is proposed, by using software which is created especially for this purposes. The steps of developing the massive evaluation of the real estates in the Republic of Moldova are mentioned.

Key words: Analysis, Evaluation report, GIS, methods, taxes.

INTRODUCTION

Assessment of real estates from the Republic of Moldova is relatively a young kind of activity that derives from the market economy specific and proportions required by it. The start point of assessment activity was the privatization of real estates, in result of which there appeared the private property, its inclusion in the civil circuit, formation and development of real estate market, necessity of determination of real estates' market value due to the fact that these could be freely traded. In the economic circuit there were included lands and constructions that in the centralized economy belonged to the state and which value was undisputed. Hence, the assessment of real estates plays a very important role in market infrastructure because it excludes the suspicious attitude of parties concerning the property's value. The real estate market develops remarkably, fact that imposes new requirements towards the assessment activity, which in July 2002 was declared as independent activity type expanded according to a well determined methodological framework.

This work presents the results of the studies performed by authors that assessed massively for tax purposes. We tried to define the place and importance of determining real estates' value by massive assessment and bringing in these investigations within the evaluation activity. The reasoning of the topic was made upon the studies and necessity of implementation of massive assessment in order to be settled truly the owners' contribution to local budgets.

The set goals from this work are: to study and make some implementations of massive assessment, to examine the automation process of data collection and processing, to study the trends and possible classifications, to facilitate the process of determining tax duty, to get acquainted and to apply Value Cad module, to come up with proposals and changes concerning the developing procedure of massive assessment process, to implement the performed technologies to data processing got in the result of participation in massive assessment activity of real estates.

MATERIALS AND METHODS

Cainarii Vechi is a village and a parish from Soroca district. The village is located to 48.003851 – North latitude and to 28.127697 – East latitude, having an aria of almost 4.34 square kilometers with a perimeter of 12.01 km. The parish Cainarii Vechi has a total area

of 65.64 square kilometers, being included in a perimeter of 45.01 km. In the parislocalities within the parish is around 4.89 square kilometers. In Cainarii Vechi village there are almost 1800 real estates (living houses) it means that 98% of them are privately owned. In Floriceni village, we found over 100 houses arranged according to a new design urban planning.

In Cainarii Vechi village there were registered 1309 households in 2004. The number of the owners of these households was 3262 people and the average number of people living in such households was 2.5. In the parish, the houses were distributed according to the number of people that live there, pursuant to the following diagram:
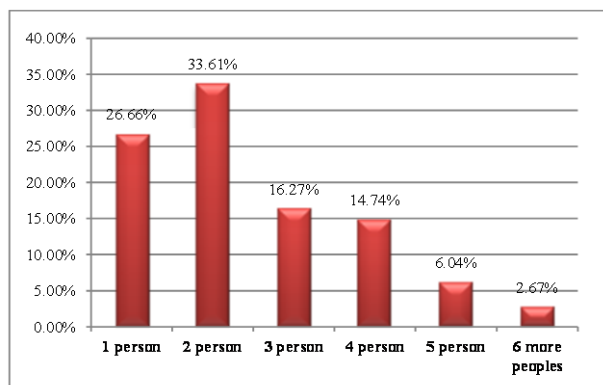
Figure 1. Distribution of households according to the number of people in family

The massive assessment of real estates is really expensive and the funds for the implementation of the new assessment system are used for the execution of the following works:
1) gathering and analysis of data concerning the real estates, information necessary for the assessment;
2) development of maps of value areas;
3) developing assessment models for all types of real estates located in the Republic of Moldova;
4) assessment of real estate;
5) sending notices to the owners concerning the estimated value of real estates;
6) settlement of disputes related to estimated value;
7) transmission of data to tax authorities;

The condition of the real estates from Cainarii Vechi parish isn't the best. The results the

investigations concerning this factor can be analyzed in the following diagram:
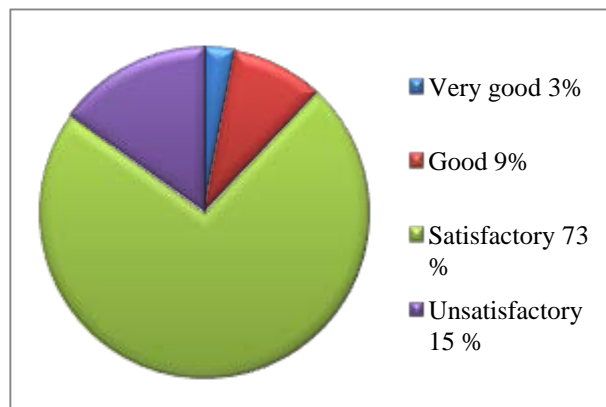
Figure 2. Analysis of technical condition of real estates from Cainarii Vechi parish, Soroca district

The funds are distributed based on the development of massive assessment works for the real estates according to the schedule.
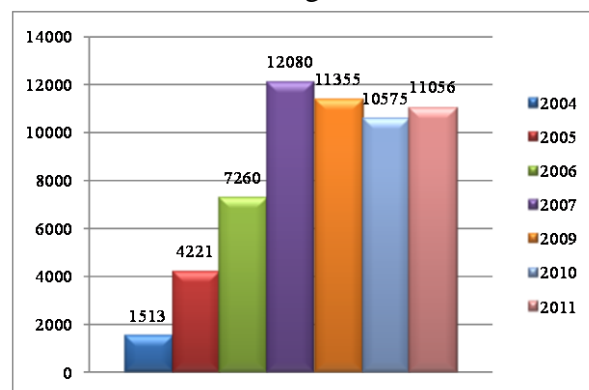
Figure 3. The total amount of money allocated for massive assessment works of real estates thousands MDL

RESULTS AND DISCUSSIONS

In the result of massive assessment works of real estates from Cainarii Vechi village, Soroca district, there were filled 1401 forms that contain extensive information about the individual living houses, legal data about their owners, total number of adjacent constructions, year of construction of each house, information about construction materials, house's roof and total number of wells. There was also settled the condition of each construction and the cover of the access road for each household. A very important role for the massive assessment of the real estates is the land area around the house.

The massive assessment works in Cainarii Vechi village started concurrently with cadastre project. They expanded in several stages:

- Gathering of legal information and filling standard forms on the territory of the village;
- Execution of massive measures of the lands around the houses;
- Analysis and correction of area errors, owners' last name and name, checking information about owners' dates of birth;
- Analysis of legal documents that confirm the ownership of the real estate;
- Correlation and correction of the errors in standard forms;
- Assignation of cadastral codes to the real estates;
- Entering information about the real estates and their owners in Legal Cad database;
- Establishment and assignation of 2 value regions for the entire area of the village
- Entering technical information about the real estates (from standard forms) in Value Cad database;
- Settlement of adjustment coefficients for calculating the value of real estate;
- Calculation of real estates' value;
- Analysis of the obtained results and overlap with data about market values of the real estates in the given region;
- Approval of assessment results;
- Setting average values for different measurement units in this locality

The majority of real estates from the village territory are privately owned. Due to the fact that the assessment works from the parish are in development course and the information about the real estates is being entered in Legal Cad, in the table below we will present the received results after assessment of individual living houses that were previously registered in Legal Cad database, using adjustment factors developed for Soroca district that were approved by the Agency of Land Relations and Cadastre, making changes to the coefficients of value region, because there were developed 5 value regions for Soroca town, and for each region corresponds an adjustment coefficient from 1,08 for the central region of the town to 0.86 for the suburbs. The calculations were performed using the value region coefficient of 0.5 and are presented in tabular form:

CONCLUSIONS

The massive assessment work of the real estates requires very high theoretical training, both concerning the chapter of massive assessment and legal chapter, due to the fact that during the filling of standard forms we faced a range of questions that came from the owners as: "How could I entail the real estate?", "What should I do if my neighbor violates my property by changing the borders?", „How could I buy legally a plot of land ?" to which we had to answer with maximum accuracy without avoiding the answer.

The information gathering for the standard forms requires 23-25 minutes for each real estate, that is followed by the stage of checking and correction of information from the standard forms that also involves 10 minutes per each real estate

The massive assessment is lengthy process. Due to this, during the tax collection it is recommended the implication in this process of the owners who could fill the standard forms on local public administration request, fact that will give a higher veracity of collected data and would allow saving money assigned for this type of assessment.

The results of calculating the value of real estate in this village are lower than the ones obtained after the individual assessment, fact that reduces the taxable amount from this village.

The automated module Value Cad is necessary to be modified and adapted to the conditions and requirements of the collected information in the result of massive assessment, because the standard forms that were filled in Cainarii Vechi village were simplified. There are missing several words and namely: windows' type, fence's material. Their absence was motivated by the fact that they don't influence a lot the value of the real estate.

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ASPECTS OF ACHIEVING PRECISIONS IN MINING PENETRATIONS

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Abstract

The present papper deals with the aspects of precision, obtained in the case of front and contra-front projects and in cases in which the mining project has to get to other existing subteranian projects. From an economic perspective it is very important that the piercing to be done properly to avoid additional work to correct the deviations that occurred.

Keywords: mining penetrations, precision, deviations, topography

INTRODUCTION

Deposits of useful minerals beneath the earth's crust open mining is placed according to some projects should contain all the necessary surveying their land materialize. In this context, we can say that precede surveying mining in that their projects is based on data from surveying. Also present in surveying mining and location measurements and control so that they fit into the project, and finally ending mining reception measurements (Dima, 1996).
 Continuity and consistency of topographic work surface and underground at a mine shall ensure the existence of a common reference name topographic system. One such reference system is determined by the bond is between the work surface topography and underground, it materializes the elements as it is known, coordinates a project materialized toprografic mining work performed at a particular horizon and orientation of directions also materialized on that mining work (Popia, 2008).

MATERIALS AND METHODS

Consider an open deposit by two vertical wells including underground mining work are carried horizontally.
If the surface where the mining work is transmitted horizontally by two F_{309} and F_{300} ballasted wire coordinates of two points 309 and 300, then between them can be achieved poligonaţie (non-mining) whose points P_3 intermediates are denoted by P_4, P_1, N.
Solving this polygonal route aims to determine the coordinates of waypoints, which is possible by knowing the following quantities:
-coordinates X_{309}, Y_{309}, X_{300}, Y_{300} of the points 309 și 300 – which are known;
- angles β_1, β_2,..., β_n and distances D_{P3}, D_{P4}, D_{P1}, D_N – which are measured.
It is obvious that the determination of the coordinates of the points P_3, P_4, P_1, N of the reference system can be embodied in various ways other than those required.
It is considered, however, topographic features (coordinates of a point and a direction orientation) evidenced by two stable points in the ramp of one of the two wells (eg points P_3 and P_4).
We consider separately two polygonal route with two fixed points used for reference system transmission.
Route points can be related to two Cartesian reference systems: the general and the particular system 309_{xy} $309_{x'y'}$. The latter has an axis along the first side of the polygonal path, the other perpendicular to the side in point 309 (Figure 1).
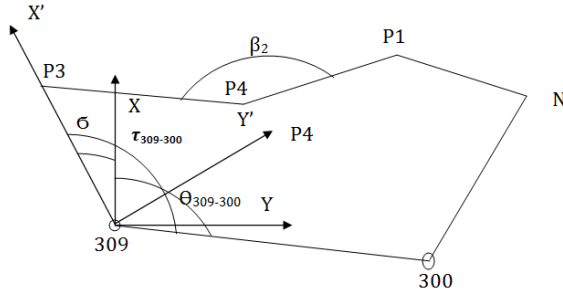
Figure 1. Polygonal route

RESULTS AND DISCUSSIONS

Orientations calculation in the particular system:

In particular the reference system can be calculated guidelines τ sides of the route as follows:

$\tau_{309\text{-}P3} = 0$

$\tau_{P3\text{-}P4} = \tau_{309\text{-}P3} + \beta_1 \pm 200$

$\tau_{P4\text{-}P1} = \tau_{309\text{-}P3} + \beta_1 + \beta_2 \pm 2*200$

$\tau_{P1\text{-}N} = \tau_{309\text{-}P3} + \beta_1 + \beta_2 + \beta_3 \pm 3*200$

$\tau_{N\text{-}300} = \tau_{309\text{-}P3} + \beta_1 + \beta_2 + \beta_3 + \beta_4 \pm 4*200$

Coordinates calculation in the particular system:

Also, the orientations values set out above, can be calculated the coordinates X', Y' of the polygonal route points:

$X'_{P3} = X_{309} + D_{P3}\cos\tau_{309\text{-}P3}$
$Y'_{P3} = Y_{309} + D_{P3}\sin\tau_{309\text{-}P3}$

$X'_{P4} = X'_{P3} + D_{P4}\cos\tau_{P3\text{-}P4}$
$Y'_{P4} = Y'_{P3} + D_{P4}\sin\tau_{P3\text{-}P4}$

$X'_{P1} = X'_{P4} + D_{P1}\cos\tau_{P4\text{-}P1}$
$Y'_{P1} = Y'_{P4} + D_{P4}\sin\tau_{P4\text{-}P1}$

$X'_{N} = X'_{P1} + D_{N}\cos\tau_{P1\text{-}N}$
$Y'_{N} = Y'_{P1} + D_{N}\sin\tau_{P1\text{-}N}$

$X'_{300} = X'_{N} + D_{300}\cos\tau_{N\text{-}300}$
$Y'_{300} = Y'_{N} + D_{300}\sin\tau_{N\text{-}300}$

In this way the coordinates of the points 309 and 300 are known in both reference systems. Consequently, one can determine the orientation $\Theta_{309\text{-}300}$ $\tau_{309\text{-}300}$ of the two systems using the equation:

$$\text{tg}\tau_{309-300} = \frac{Y'_{300} - Y'_{309}}{X'_{300} - X'_{309}} => \tau_{309-300}$$

and:

$$\text{tg}\theta_{309-300} = \frac{Y_{300} - Y_{309}}{X_{300} - X_{309}} => \theta_{309-300}$$

the rotation angle σ is:

$$\delta = \tau_{309-300} - \theta_{309-300}$$

$$\theta_{309-300} = \tau_{309-300} - \delta$$

The polygonal route forms a rigid system, as a result the relation is valid for any of the sides of them.

The point coordinates in the general system are:

$$\begin{cases} (x_{P3}) = x_{309} + D_{P3}\cos\theta_{309-P3} \\ (y_{P3}) = y_{309} + D_{P3}\sin\theta_{309-P3} \end{cases}$$

$$\begin{cases} (x_{P4}) = (x_{P3}) + D_{P4}\cos\theta_{P3-P4} \\ (y_{P4}) = (y_{P3}) + D_{P4}\sin\theta_{P3-P4} \end{cases}$$

$$\begin{cases} (x_{P1}) = (x_{P4}) + D_{P1}\cos\theta_{P4-P1} \\ (y_{P1}) = (y_{P4}) + D_{P1}\sin\theta_{P4-P1} \end{cases}$$

$$\begin{cases} (x_{N}) = (x_{P1}) + D_{N}\cos\theta_{P1-N} \\ (y_{N}) = (y_{P1}) + D_{N}\sin\theta_{P1-N} \end{cases}$$

$$\begin{cases} (x_{300}) = (x_{N}) + D_{300}\cos\theta_{N-300} \\ (y_{300}) = (y_{N}) + D_{300}\sin\theta_{N-300} \end{cases}$$

The compensation is realised on coordinates:

$x_{P3} = (x_{P3}) + k_x D_{P3}$

$x_{P4} = (x_{P4}) + k_x(D_{P3} + D_{P4})$

$x_{P1} = (x_{P1}) + k_x(D_{P4} + D_{P3} + D_{P1})$

$x_{N} = (x_{N}) + k_x(D_{P3} + D_{P4} + D_{P1} + D_{N})$

$x_{300} = (x_{300}) + k_x(D_{P3} + D_{P4} + D_{P1} + D_{N} + D_{300})$

$y_{P3} = (y_{P3}) + k_y D_{P3}$

$y_{P4} = (y_{P4}) + k_y(D_{P3} + D_{P4})$

$y_{P1} = (y_{P1}) + k_y(D_{P4} + D_{P3} + D_{P1})$

$y_{N} = (y_{N}) + k_y(D_{P3} + D_{P4} + D_{P1} + D_{N})$

$y_{300} = (y_{300}) + k_y(D_{P3} + D_{P4} + D_{P1} + D_{N} + D_{300})$

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where: $k_x = \dfrac{f_x}{[l]}$; $k_y = \dfrac{f_y}{[l]}$

$$f_x = x_{300} - (x_{300})$$
$$f_y = y_{300} - (y_{300})$$

Errors before and after the coordinates compensation:

In the following are analised the errors of the sides orientations due to errors of angles and sides measurement of the polygonal route (Popia, 2008). Errors of the mining polygonal route sides are determined by the measurement errors of the angles and sides.

Orientations errors are determined by the angles errors:

Are obtained using the general relation:

$$m_{\theta\beta}^2 = \left(\frac{\partial\theta}{\partial\beta_1}\right)^2 m_{\beta 1}^2 + \left(\frac{\partial\theta}{\partial\beta_2}\right)^2 m_{\beta 2}^2 + \left(\frac{\partial\theta}{\partial\beta_3}\right)^2 m_{\beta 3}^2 +$$

$$+ \left(\frac{\partial\theta}{\partial\beta_4}\right)^2 m_{\beta 4}^2$$

In order to acheive the partial derivates we use:
$$\theta = \theta_{309-300} + \tau - \tau_{309-300}$$

So:

$$\frac{\partial\theta}{\partial\beta} = \frac{\partial\theta_{309-300}}{\partial\beta} + \frac{\partial\tau}{\partial\beta} - \frac{\partial\tau_{309-300}}{\partial\beta}$$

but: $\dfrac{\partial\theta_{309-300}}{\partial\beta} = 0$ and then:

$$\frac{\partial\theta}{\partial\beta} = \frac{\partial\tau}{\partial\beta} - \frac{\partial\tau_{309-300}}{\partial\beta}$$

In order to acheive the derivate $\dfrac{\partial\tau_{309-300}}{\partial\beta}$ we differentiate the expression: $tg\,\tau_{309-300} = \dfrac{y'_{300}}{x'_{300}}$ and we obtain:

$$\frac{d\tau_{309-300}}{\cos^2\tau_{309-300}} = \frac{x'_{300}\,dy'_{300} - y'_{300}\,dx'_{300}}{(x'_{300})^2}$$

$$x'_{300} = c\cdot\cos\tau_{309-300}$$
$$y'_{300} = c\cdot\sin\tau_{309-300}$$

$$\frac{d\tau_{309-300}}{\cos^2\tau_{309-300}} = \frac{c\cdot\cos\tau_{309-300}dy'_{300} - c\cdot\sin\tau_{309-300}dx'_{300}}{c^2\cos^2\tau_{309-300}}$$

or:

$$c\,d\tau_{309-300} = \cos\tau_{309-300}dy'_{300} - \sin\tau_{309-300}dx'_{300}$$

It goes from the derived differential:

$$c\frac{\partial\tau_{309-300}}{\partial\beta} = \frac{\partial y'_{300}}{\partial\beta}\cos\tau_{309-300} - \frac{\partial x'_{300}}{\partial\beta}\sin\tau_{309-300}$$

It is known that:

$$\frac{\partial y'_{300}}{\partial\beta} = R\cos\gamma \ ; \ \frac{\partial x'_{300}}{\partial\beta} = -R\sin\gamma$$

$$c\frac{\partial\tau_{309-300}}{\partial\beta} = R\cdot\cos\gamma\cdot\cos\tau_{309-300} + R\sin\gamma\sin\tau_{309-300}$$

$$c\frac{\partial\tau_{309-300}}{\partial\beta} = R\cos(\tau_{309-300} - \gamma)$$

but: $R\cos(\tau_{309-300} - \gamma)$ - is the projection of the radius R on the line 309-300 and is noted with R'

$$\frac{\partial\tau_{309-300}}{\partial\beta} = \frac{R'}{c}$$

The general expression is:

$$\frac{\partial\theta}{\partial\beta} = \frac{\partial\tau}{\partial\beta} - \frac{R'}{c}$$

With this equality is determined:

1.The error of the first side:

In this case $\tau_{309-P3}=0$ and then:

$$\frac{\partial\tau_{309-P3}}{\partial\beta_1} = \frac{\partial\tau_{309-P3}}{\partial\beta_2} = \frac{\partial\tau_{309-P3}}{\partial\beta_3} = \frac{\partial\tau_{309-P3}}{\partial\beta_4} = 0$$

$$\frac{\partial\tau_{309-300}}{\partial\beta_1} = \frac{R'_1}{c} \ ; \ \frac{\partial\tau_{309-300}}{\partial\beta_2} = \frac{R'_2}{c};$$

$$\frac{\partial\tau_{309-300}}{\partial\beta_3} = \frac{R'_3}{c} ; \frac{\partial\tau_{309-300}}{\partial\beta_4} = \frac{R'_4}{c}$$

But: $\dfrac{\partial\theta}{\partial\beta} = \dfrac{\partial\tau}{\partial\beta} - \dfrac{R'}{c}$ so:

$$\frac{\partial\theta_{309-P3}}{\partial\beta_1} = -\frac{R'_1}{c} \ ; \ \frac{\partial\theta_{309-P3}}{\partial\beta_2} = -\frac{R'_2}{c} \ ;$$

$$\frac{\partial\theta_{309-P3}}{\partial\beta_3} = -\frac{R'_3}{c} ; \frac{\partial\theta_{309-P3}}{\partial\beta_4} = -\frac{R'_4}{c}$$

$$m_{\theta 3\beta}^2 = m_{\theta 1\beta}^2 + \left(1 - \frac{2R'_1}{c}\right)m_{\beta 1}^2 + \left(1 - \frac{2R'_2}{c}\right)m_{\beta 2}^2$$

Substituting the formula error, we have:

$$m_{\theta_i\beta}^2 = \frac{(R'_1)^2}{c^2}m_{\beta_1}^2 + \frac{(R'_2)^2}{c^2}m_{\beta_2}^2 + \frac{(R'_3)^2}{c^2}m_{\beta_3}^2 + \frac{(R'_4)^2}{c^2}m_{\beta 4}^2$$

2. The error of the scond side:

In this case we have:

$$\tau_{P3-P4} = \tau_{309-P3} + \beta_1 \pm 200^g$$

from which:

$$\frac{\partial \theta_{P3-P4}}{\partial \beta_1} = 1 \; ; \; \frac{\partial \tau_{P3-P4}}{\partial \beta_1} = \frac{\partial \tau_{P3-P4}}{\partial \beta_2} = \frac{\partial \tau_{P3-P4}}{\partial \beta_3} = \frac{\partial \tau_{P3-P4}}{\partial \beta_4} = 0$$

then:

$$\frac{\partial \theta_{P3-P4}}{\partial \beta_1} = 1 - \frac{R'_1}{c} \; ; \frac{\partial \theta_{P3-P4}}{\partial \beta_2} = 1 - \frac{R'_2}{c} \; ; \; \frac{\partial \theta_{P3-P4}}{\partial \beta_3} = 1 - \frac{R'_3}{c}$$

$$m_{\theta_2\beta}^2 = \left(1 - \frac{R'_1}{c}\right)^2 m_{\beta_1}^2 + \left(\frac{R'_2}{c}\right)^2 m_{\beta_2}^2 + \left(\frac{R'_3}{c}\right)^2 m_{\beta_3}^2$$

Comparing the obtained expressions we have:

$$m_{\theta_2\beta}^2 = m_{\theta_1\beta}^2 + \left(1 - \frac{2R'_1}{c}\right)m_{\beta 1}^2$$

If the polygonal route is long enough then:

$$\frac{2R'_1}{c} > 1 \; ; \; so \; m_{\theta_2\beta}^2 < m_{\theta_1\beta}^2$$

3. The error of the third side (Table 1):

In this case:

$$\tau_{P4-P1} = \tau_{309-P3} + \beta_1 + \beta_2 \pm 2 \cdot 200^g$$

Analogously to the previous case we obtain (Table 2):

4. The error of the "i" side:

$$m_{\theta i\beta}^2 = m_{\theta 1\beta}^2 + \left(1 - \frac{2R'_1}{c}\right)m_{\beta 1}^2 + \left(1 - \frac{2R'_2}{c}\right)m_{\beta 2}^2 + ...$$

$$+ \left(1 - \frac{2R'_{i-1}}{c}\right)m_{\beta i-1}^2$$

Table 1 -Mining Polygonal route (general system)

PS	PV	β / θ / c q / g. c. cc.	Cadran / Sign / θχ / θ	L / φ / cos j / sin j	D / cos q / sin q / [D]	ΔΞ / X' / Cx / X	ΔΨ / Y' / Cy / Y	ΔZ / Z' / Cz / Z	Point
						585590.473	391005.560	356.850	300
	309		0.0000			585570.980	390938.250	356.180	309
	300			25.526	25.460	23.989	-8.531	-1.830	
1.363				104.5671	0.942198	585594.969	390929.719	355.613	
309				-0.07168	-0.33506	-0.00177	-0.00612	-0.00791	0.1
	P3		378.2490	0.997428	25.460	585594.967	390929.713	355.605	P3
	309			33.798	33.758	14.642	30.417	-1.652	
1.465				103.1123	0.433733	585609.610	390960.136	355.327	
P3				-0.04887	0.901042	-0.00412	-0.01423	-0.01840	0.1
	P4		71.4393	0.998805	59.218	585609.606	390960.122	355.308	P4
	P3			25.161	25.119	12.310	21.895	-1.457	
1.373				103.6873	0.490084	585621.921	390982.032	355.143	
P4				-0.05789	0.871675	-0.00587	-0.02027	-0.02620	0.1
	P1		67.3933	0.998323	84.337	585621.915	390982.012	355.117	P1
	P4			39.44	39.418	9.305	38.304	-1.311	
1.263				102.1166	0.236059	585631.226	391020.336	354.995	
P1				-0.03324	0.971739	-0.00861	-0.02974	-0.03845	0.1
	N		84.8289	0.999447	123.755	585631.217	391020.306	354.957	N
	P1			43.327	43.324	-40.741	-14.736	0.528	

1.479				99.2245	-0.94038	585590.485	391005.600	356.902	
N				0.012181	-0.34013	-0.01163	-0.04015	-0.05191	0.1
	300		222.0943	0.999926	167.079	585590.473	391005.560	356.850	300
	N			70.138					
1.46				101.7988					
300									0.1
	309								309

$$\tau = \quad 103.8051 \quad 82.0541 \quad 21.7510$$
$$D = \quad 70.11781 \quad 70.07601 \quad 0.04180345$$

$$W_{x,y,z} = \quad -0.012 \quad -0.040 \quad -0.052$$
$$C_0 = \quad -0.000070 \quad -0.000240 \quad -0.00031070$$
$$T_{x,y} = \quad 0.091582$$
$$T_z = \quad 0.070358$$

Table 2 - Mining polygonal route (particular system)

		β	Cadran	L	D	ΔX	ΔY	ΔZ	
PS	PV	θ'	Sign	φ	cosθ	X'	Y'	Z'	Point
		c θ	θᶜ	cosφ	sin θ	Cx	Cy	Cz	
		g. c. cc.	θ	sin φ	[D]	X	Y	Z	
						0.000	0.000		
	309			0.0000		0.000	0.000	356.180	309
	300	0.0000		25.526	25.460	25.460	0.000	-1.830	
1.363		0.0000		104.5671	1	25.460	0.000	355.613	
309				-0.07168	0				0.1
	P3		0.0000	0.997428	25.460	25.460	0.000	355.613	P3
	309	293.1903		33.798	33.758	3.604	33.565	-1.652	
1.465		93.1903		103.1123	0.106763	29.064	33.565	355.327	
P3				-0.04887	0.994285				0.1
	P̄4		93.1903	0.998805	59.218	29.064	33.565	355.327	P4
	P3	195.9540		25.161	25.119	4.263	24.754	-1.457	
1.373		89.1443		103.6873	0.169696	33.327	58.319	355.143	
P4				-0.05789	0.985496				0.1
	P1		89.1443	0.998323	84.337	33.327	58.319	355.143	P1
	P4	217.4356		39.44	39.418	-4.067	39.208	-1.311	
1.263		106.5799		102.1166	-0.10317	29.260	97.527	354.995	
P1				-0.03324	0.994663				0.1
	N		106.5799	0.999447	123.755	29.260	97.527	354.995	N
	P1	337.2654		43.327	43.324	-33.449	-27.534	0.528	
1.479		243.8453		99.2245	-0.77206	-4.188	69.993	356.902	
N				0.012181	-0.63555				0.1
	300		243.8453	0.999926	167.079	-4.188	69.993	356.902	300

CONCLUSIONS

The process to establish the expressions of errors before and after compensation is similar to that presented in full polygonal routes except that in the mining polygonal routes the angular error W_β is missing so can not be determined only m_x, m_y and M_x, M_y of the points

coordinates of the route. Established formulas are valid in this case.

In mining polygonal routes is very important to examine errors that form the sides of route. These errors are composed of errors for connection of the topographic surface features, plus the design errors, attachment errors, and measurement errors in the ground, and side angles of the mining polygonal route.

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ANALYSIS OF PLANIMETRIC ACCURACY OF OLD MAPS OF TRANSYLVANIA

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Abstract

The target of this paper is the analysis of some old maps of Transilvania from different periods of time in order to obtain information about the planimetric position accuracy of cities and also information about the maps. In the first part will be presented each map and operations used to analyse those maps. In the second part the results will be presented and compared in order to get to a conclusion.
Key words: accuracy, Helmert transformation, Mercator projection, old maps.

INTRODUCTION

In this paper the main objective is to determine the accuracy of some old maps of Transylvania designed in period of time of almost three centuries. Our research starts with the map of Transylvania that has a mathematical support, map made by Gerardus Mercator in 1616, and ends with a map published in 1862 made in a surveying campaign during the period of Austro-Hungarian domination. Knowing the accuracy of the old maps we can determine how much we can trust in those maps in order to obtain historical and geographical information in the future researches.

MATERIALS AND METHODS

We have analysed three maps: first one is from 1616 made by Gerardus Mercator, the second is made by Johann Schreiber in 1730 and the last one in 1862 by an unknown author.
The first map studied is "Transsylvania" (figure 1), made by the great geographer, cartographer and mathematician Gerardus Mercator. We assumed that this map was realised in the projection that bears his name. This map is the first map of Transylvania that has a network of meridians and parallels, being the first with a mathematical support. Previous maps of this region are considered to be only paintings or drawings realised with empirical methods.

Figure 1. „Transsylvania", Gerardus Mercator, 1616

As we can observe on this map, the longitude is translated to East with about 23 degrees. The position of the details like relief, hydrographic network and human settlements indicates also that the map is rotated with an angle that differs from the actual maps orientation.
This map has in the bottom right corner a graphic scale divided in German miles.
Knowing that a German mile was almost 8 kilometers in that period we can assume that the scale of this map is about 1:2 000 000.

The names of the settlements are written in German and the most important of them have the Hungarian name too. We have identified on this map a number of 23 cities that can be found on actual maps.

Figure 2. "Neue Kriegs Kharte von Siebenburgen, Moldau, Walachey", J.G. Schreiber, 1730

In the second map we can find Transylvania in the center (figure 2). After observing the aspect of the network of meridians and parallels we can assume that this map is made in a conic projection. In the top left corner, the map has a graphic scale divided in German and Hungarian miles, indicating that the map scale is approximately 1:3.500.000. We have identified 13 cities that can be found today on the territory of Transylvania.

Our study ends with a map published in 1862 that illustrates the Grand Duchy of Transylvania (figure 3). The difference between this map and the first one is that this map is realised based on precise measurements during one of the well-known surveys of the Austro-Hungarian Empire. In the right side of the map is a legend that provides us information about the symbols used by the author, such as: infrastructure, human settlements, relief, hydrographic network and also natural resources. The scale of the map is 1:200 000.

We have also included in our study an actual map of Romania, which is the base of planimetric accuracy comparison.

In order to make possible the study of precision, all the maps have to be made in the same projection and the same coordinate reference system.
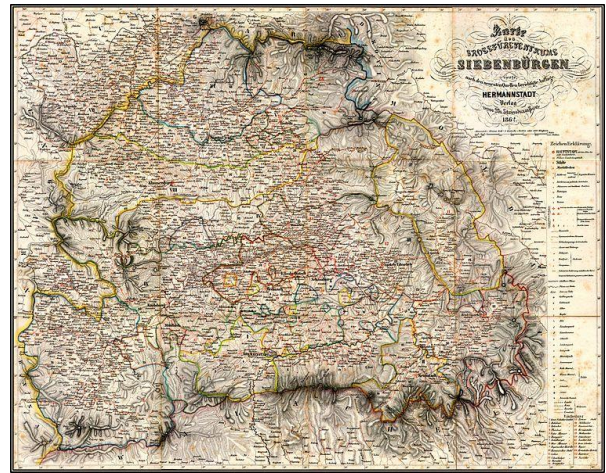
Figure 3. "Karte des Grossfürstentums Siebenbürgen", 1862
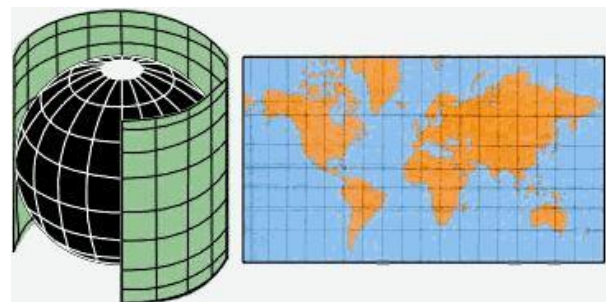
Figure 4. Cylindrical projection

The Mercator projection is a cylindrical projection introduced in 1569 by cartographer Gerardus Mercator. The Earth's surface is projected onto the surface of a cylinder which then carries out the plan by cutting cylinder after one of its generators (figure 4). The cylinder axis coincides with the poles axis. We approximate the Earth with a sphere of radius 6.375.000 meters and the cylinder being tangent at this sphere on equator. All the maps have been transformed in Mercator projection using formulas:

$$\begin{cases} X = \frac{\alpha}{0.4342945} \lg\left[tg\left(45^o + \frac{\varphi}{2}\right)\right] \\ Y = \alpha\,\lambda \\ \alpha = R\,\cos\varphi_k \ ; \ \varphi_k = 0 \end{cases} \quad (1)$$

Using formulas (1) we have calculate rectangular coordinates (X, Y) for each node of the network of meridians and parallels. Then we have represented these points using AutoCAD. Based on these points we have georeferenced all maps. In this way the meridians and parallels networks have become rectangular. The georeferencing was realised using Autodesk software, AutoCAD and Raster Design.

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In order to bring the maps in the same coordinate reference system we have applied the Helmert transformation with 4 parameters, consisting in a translation on the North axis (OX), a translation on the East axis (OY), a rotation ε and a scale factor m.
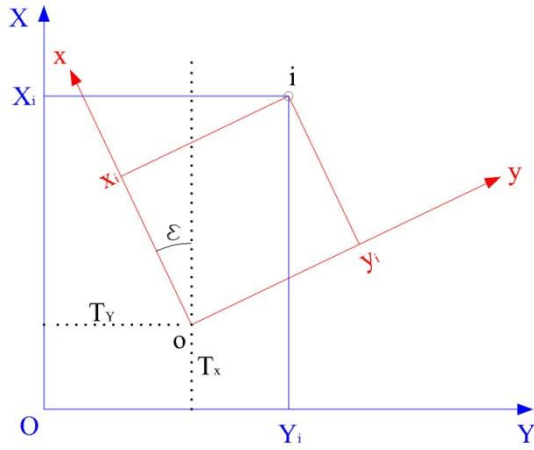
Figure 5: Helmert transformation with 4 parameters

In fig. 5, XOY is the system of the actual map and xoy is the system of each old map.

With notations: $a = m\,cos\varepsilon$, $b = m\sin\varepsilon$, c = Tx, d = Ty, the formulas of transformation from a system to another become:

$$\begin{cases} X = ax - by + c\;; \\ Y = bx + ay + d\;; \end{cases} \quad (2)$$

For each point i that have coordinates in both systems we can write 2 equations:

$$\begin{cases} V_{X_i} = a\,x_i - b\,y_i + c - X_i \\ V_{Y_i} = b\,x_i + a\,y_i + d - Y_i \end{cases} \quad (3)$$

In the (3) formulas the corrections V_{X_i} and V_{Y_i} represent the comparison basis for accuracy of the cities.

RESULTS AND DISCUSSIONS

For each map the Helmert transformation was made using 10 major common cities: Alba Iulia, Bistrița, Brașov, Cluj, Dej, Făgăraș, Mediaș, Sebeș, Sibiu, Sighișoara.

After applying the Helmert transformation in the Mercator's map, "Transsylvania, we have obtained the following paramters:

Tx = 150 432 m, Ty = 2 577 483, rotation ε = 40˚ and scale factor m = 0.976302. The East axis translation, Ty, corresponds to the difference of longitude between the prime meridian of the actual map, Greenwich, and the prime meridian used by Mercator. Using the (1) formulas we have determined that the origin on longitude on Mercator's map is 23˚09' West from Greenwich meridian, passing through Cape Verde Islands.

Applying the transformation parameters we get the results presented in Figure 6:
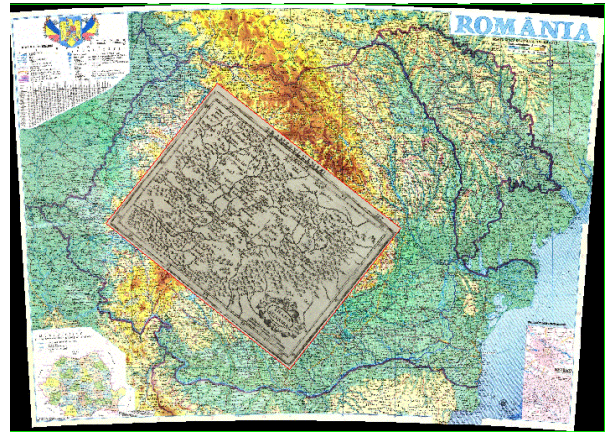
Figure 6. Transformation parameters for the map "Transsylvania"

Table 1. Planimetric accuracy for the cities on the map "Transsylvania"

City	s [km]
Alba Iulia	22.9
Bistrița	29.6
Brașov	25.8
Cluj	5.8
Dej	20.9
Făgăraș	24.6
Mediaș	23.8
Sebeș	21.2
Sibiu	17.3
Sighișoara	10.7

As we can observe in table 1, the average position error on this map is about 20 kilometers.

For the second map, made in 1730, we have obtained the following parameters: translation on the North axis: Tx = 62 338 m, translation on the East axis: Ty = 2 513 815 m, rotation: ε = 23˚26' and the scale factor: m = 1.104286 (Figure 7).
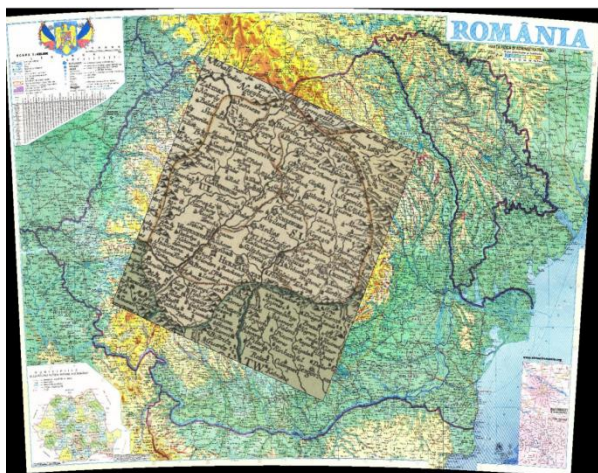
Figure 7. Transformation parameters
for the map made in 1730

Table 2. Planimetric accuracy for the cities of the map
„Neue Kriegs Kharte", 1730

City	s [km]
Alba Iulia	2.5
Bistrița	23.5
Brașov	12.2
Cluj	21
Dej	6.3
Făgăraș	17
Mediaș	3.2
Sebeș	18.4
Sibiu	4.9
Sighișoara	19.2

In Table 2 is presented the position errors for the most important cities.

The average position error on this map based on table 2 is 12.82 kilometers.

On the last map which was made based on precise observations, we have obtained the following parameters: Tx = -2740 m, Ty = 1

971 239 m, rotation ε = - 00˚51' and scale factor m = 0.994199 (Figure 8).

Based on the Ty translation results that this map uses the Ferro meridian which passes through the Canary Islands.
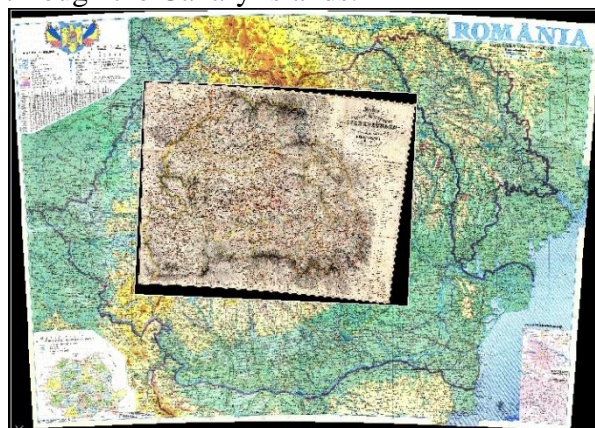
Figure 8. Transformation parameters for 1862 map

Table 3. Planimetric accuracy for the cities of the map „ Karte des Grossfürstentums Siebenbürgen ", 1862

City	s [km]
Alba Iulia	3.5
Bistrita	4.6
Brasov	1.2
Cluj	1.8
Dej	4.8
Fagaras	1.3
Medias	1.3
Sebes	2.6
Sibiu	1.3
Sighisoara	2.8

On this map the average position error for those 10 cities is 2.52 kilometers, as we can see in table 3.

CONCLUSIONS
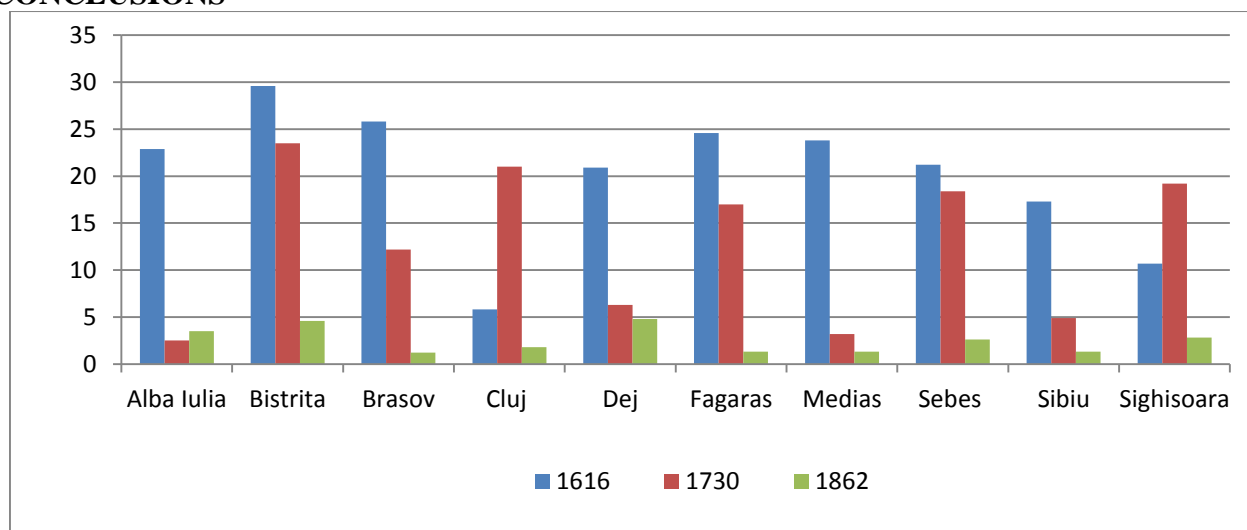
Figure. 9: Planimetric accuracy for 10 most important cities

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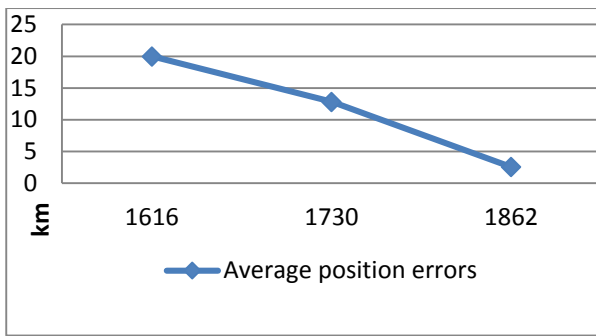
Figure 10. Average position errors
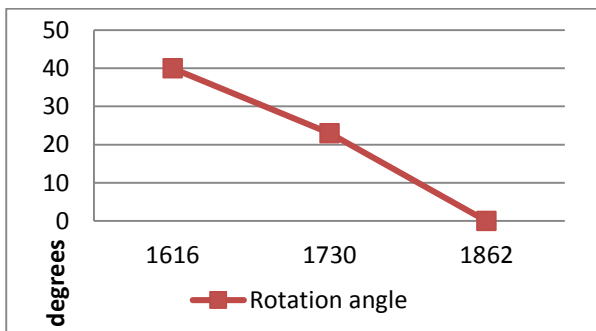
Figure 11. Rotation angle

As we can see in the Figures 9 and 10, the map made in 1862 is by far the most accurate and between this map and the modern maps it is a significant difference. This is due to precise surveys.

For the Mercator's map, the average position error is about 20 kilometers and judging by the instruments and the methods that he used at that time, we can consider that his map is still a very important tool in analyzing the historical and geographical landscape of Transylvania of 17th century. Considering that the scale of this map is about 1: 2.000.000, a graphic error of 1 millimeter represents 2 kilometers. That means

that for those times, the Mercator's map was one of the most accurate maps of Transylvania. For Schreiber's map made in 1730, as we can see in the fig. 10, the average error is about 13 kilometers. In the fig. 9 we can see that the errors are not uniform. Some cities such as Alba Iulia, Dej, Mediaş and Sibiu have small errors, while other cities like Bistriţa and Cluj have errors bigger than 20 kilometers. In that time the precise surveying were barely started so we can assume that those measurements were not made in all those cities.

In the fig. 11 it is represented how the abnormal orientation of those three maps is changing. The orientation of the map made in 1862 is almost identical with modern maps orientation.

The rotation angle can also be an argument for the big errors which occur on the first two maps and as we observed once the rotation angle decreases the translation on North axis decreases too.

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STATISTICAL ANALYSIS ON THE ACCURACY OF DETERMINING THE COORDINATES OF THE POINTS WITH GPS EQUIPMENT IN FORESTRY SECTOR

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Abstract

The purpose of this paper is to perform a statistical analysis based on many factors that influence accuracy of determining the coordinates of the points in the forestry sector, points determined by GPS technology, the method used is Stop-and-go. Factors influencing the accuracy of determining the points are: composition stands, consistent, age, land orography, exhibition etc. This paper aims forests that are under the administration of RPLP PC Zarnesti, area where there is already a GIS project, which includes the observations on the factors that influence accuracy, listed above, and coordinates obtained from measurements made by GPS technology. The conclusion resulting from the statistical analysis performed is that the accuracy of determining the coordinates of the points by GPS technology is greater on heights and much weaker on valleys with North-South exhibition.

Key words: accuracy, forestry sector, GPS, land orography, composition

INTRODUCTION

Global positioning systems are composed of several constellations of satellites orbiting the Earth, constantly transmitting ground receiver position, with waves radio.On TOA (time of arrival) basis, after the needles have received satellite signals, receiver calculates the 3 dimensional elements of the globe position (longitude, latitude and altitude) according to the transmission time of messages and the position of at least four satellites in orbit. The best known is the GPS positioning system (Glove Positioning System) - American system was developed as a military application but, in present, is free provided for civilians.

The data analyzed in this paper were collected with GPS equipment in dual frequency (L1, L2) using Stop-and-go method, and beeing post-processed using the corrections from a reference station nearby. The studied zone is in the upper basin of Birse, near Zarnesti. Statistical analysis was performed only for spruce forests from the study area.(the study area is represented in Figure 4).

Figure 1. An image taken from a graphic artist to Terra suggesting positioning of one of the satellites of the GPS system

MATERIALS AND METHODS

The data obtained from the measurements were taken over several days with GPS equipment (two types of receivers in dual frequency-Trimble Proxrt, Trimble Proxh). In order to analyze the accuracy of their determination based on certain criteria, I used an existing GIS which contained information about relief,

exposition , crown density of the stand, composition, age, etc. .. Further, various combinations were made from two criteria reaching up to five criteria. (eg two criteria: spruce forest on valley, spruce forest with crown density of the stand 0.7-0.8, spruce forest age 81-100 years, spruce forest on southern exposition, ex. 3 criteria: spruce forest on valley with crown density of the stand 0.9-1, spruce forest age 1-20 years on Eastern exposition, ex. 4 criteria: spruce forest on slope age 81-100 years, crown density of the stand 09-01; ex .5 criteria: spruce forest on slope age 101-120 years crown density of the stand 07-08 and on North exposition. The analyse were performed for each one of these combinations regarding the points precision and to achieve it have been established certain thresholds: the orography have been divided into valley, slopes and ridge, the crown density of the stand have been divided in crown density >=0.6, 0.7-0.8 and 0.9-1.0, age in thresholds of 20 to 20 years (1-20, 21-40, 41-60, 61-80, 81-100, 101-120, 121-140) and exposition in Northern(N), Southern(S), Eastern(E), Western(W), N-E, N-W, N-S, S-E, S-V, NE-SV, NV-SE.

RESULTS AND DISCUSSIONS

After I relized all possible combinations on the accuracy of determining the coordinates of the points in the forestry sector (especially the spruce forest) with GPS equipment, were calculated averages of all the points that define each combination in hand, but before I calculated the coefficient of variation which shows if the community is homogeneous or inhomogeneous.If coefficient of variation is lower than 30% it means that the community is homogeneous and the arithmetic mean can be used.Otherwise, must calculate other parameters, such as:quartile, percentile, median etc.which helped getting the final result. In the analysis were obtained the results that are represented in Figure 2.

As we can see, the precision of determining the point with GPS equipment is higher on ridge (on average 0.3 m) and lower on valley. Analyzing combinations of 2 criteria at a time, the accuracy in spruce forest will be higher when crown density of the stand is lower than 0.6, when the exhibition is EV and age is

between 1 and 20 years and obviously, as shown above when measurements are made on the ridge. The accuracy will be lower on valley, slopes with northern exposition, age between 121 and 140 years or in forests with crown density of the stand 09-1.
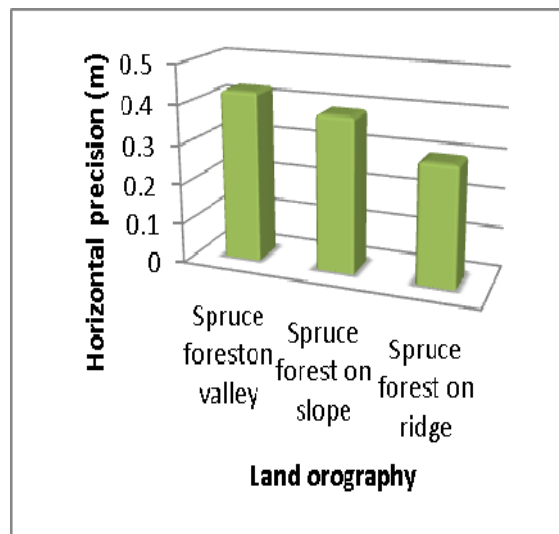
Figure 2. The results on analysis performed based on land orography

Continuing with the combination of 3 criteria, were obtained following results (as you can see in Figure 3):
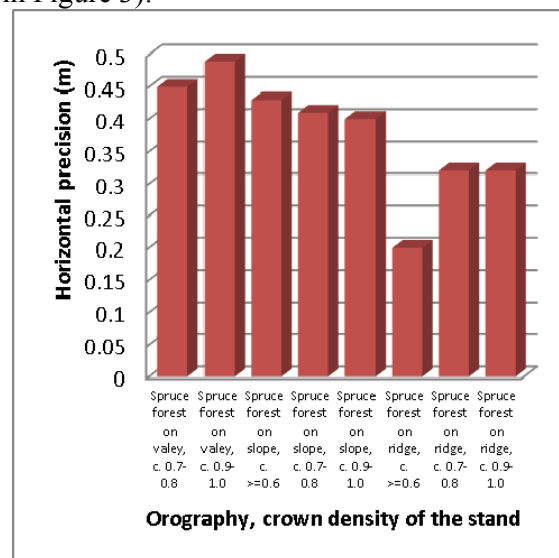
Figure 3. The results on analysis performed based on land orography and crown density of the stand

In combinations that were used criteria related to orography and crown density of the stand, the best accuracy is reached in spruce forests located on the ridge with crown density lower than 0.6, the weakest precision is touched on valley with crown density 0.9-1 (as you can see

in the chart above). When using orography criteria and age, the best accuracy resulted is in the forests on the ridge between the ages of 1 and 20 years and the worst in the valley between the ages of 61 and 80 years. Taking into consideration topography and exposition accuracy resulted the highest precision on ridge and exhibition Northern Eastern-Southern Western (NE-SW) and the weakest on the Northern exposition on slopes.

In the statistical analysis conducted in combinations of 4 criteria, there were 109 combinations analyzed in spruce forest and the result is that the best accuracy will be found in combination: spruce forest with crown density of the stand lower than 0.6 located on ridge with NE-SW exhibition with an age of 1 to 20 years. Obviously, the worst precision will be in the combination that contains spruce forest on slope with Northern exposition, with crown density of the stand 0.9-1.0 and an age between 61-80 years.
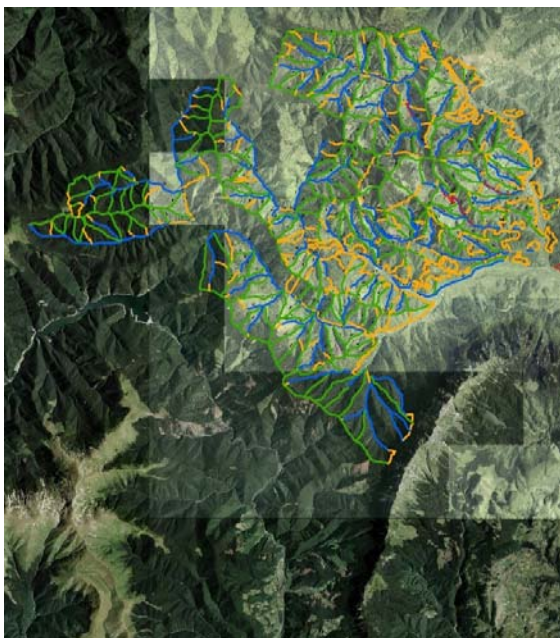
Figure 4. The study area

CONCLUSIONS

The conclusion resulting from achieving statistical analysis on the accuracy of determining the coordinates of the points in the forest (spruce forest) with GPS equipment is one obvious as it is logical that on the ridge will be the highest accuracy of determining the coordinates of the point because the sky is relatively free, on the valley the signal of the satelites is blocked by the slopes that surround the valley or on the slopes with Northern exposition where the signal will be very weak because the direction of the satellites is also EV.Also, the accuracy will be much better in young forests where canopy cover is not consistently affect accuracy.It is obviously that the crown density of the stand will also influence the precision and the accuracy will be better on a forest with lower crown density.

ACKNOWLEDGEMENTS

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COMPARATIVE ANALYSIS ON THE PRECISION OF DETERMINATION OF GEODETIC POINTS USING THE STATIC METHOD AND RTK TECHNIQUE

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Abstract

The purpose of this study is to compare the precision of the geodetic points determined with GNSS methods using statistical calculations. Therefore I realized a statistical analysis of the results obtained after processing the data. The analyzed points are localized in the surroundings of Braşov City, Romania, being in number of about 557, of which 541 RTK, and 16 static determined points. Depending on the area, exposure and a number of other factors the precision of the points was different. The stationary time for the RTK determined points varies from minutes to seconds, and for the points determined using the static method the stationary period was much longer, namely around two hours. The stationary period on each point as well as the area in which the points are found directly influences the precision of the geodetic points coordinates.

Key words: RTK, GNSS, stationary period, precision, static determined.

INTRODUCTION

The knowledge and the application of statistical calculations is absolutely necessary, since any study or research must be documented with the statistical analysis of the results (Văleanu, Hîncu, 1990).

Statistics is the science that deals with the description and analysis of numerical mass phenomena. It studies the quantitative side of phenomena, the statistical laws being manifested in the form of trends (Văleanu, Hîncu, 1990).

In this context, the study presents a statistical analysis of the positioning precision both planimetric and altimetric and also planimetric + altimetric, of the points taken with the RTK technique and static method in different areas, different terrain conditions and different time periods, to emphasize the quality of the measurements regarding each method.

The static method requires that, when performing observations, the receivers installed on the reference station and on the new station (or stations), to remain fixed in a session in which they receive signals from at least the same minimum four satellites. The observation time is long, dual frequency receivers are required, which ensure high precision, owned by the higher order networks, with bases greater than 10 km (Bos, Iacobescu, 2009).
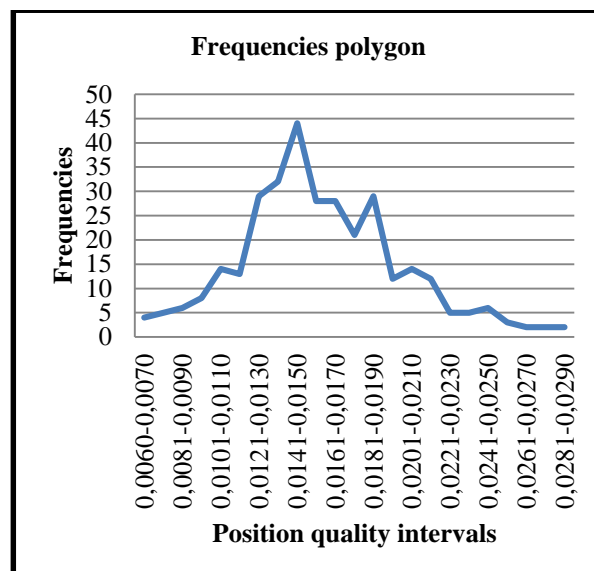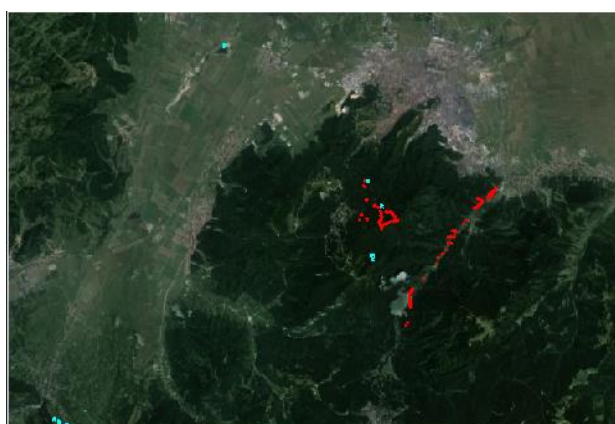
The real-time measuring method (RTK) also known as real-time kinematic method eliminates the main drawback of the static method, which involves positioning only through post-processing (Bos, Iacobescu, 2009).
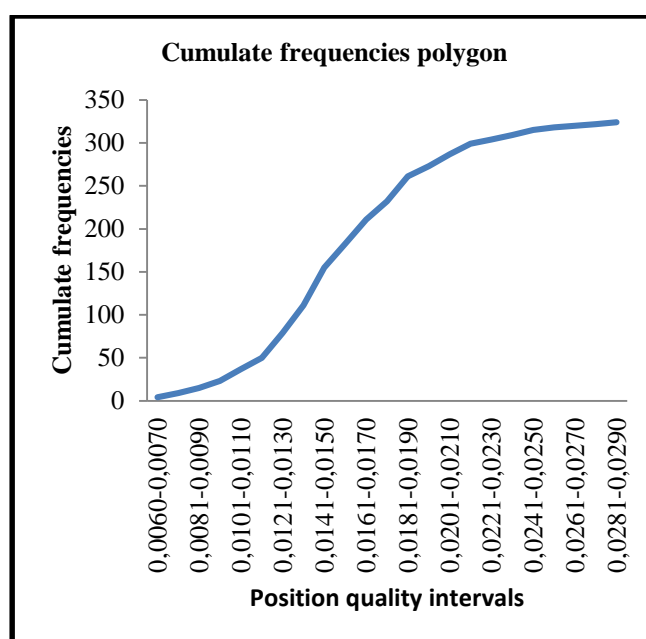
MATERIALS AND METHODS

In order to characterize the quality of each method, for the RTK points as well as for the static determined points, were extracted a number of quality parameters using the Leica Geo Office program version 5.0 (Figure 1). These parameters are: the quality of the position (Posn. Qlty.), the height quality (Hgt. Qlty.) and the position + height quality (Posn. + Hgt. Qlty.).

Figure 1. The Leica Geo Office v. 5.0 parameters
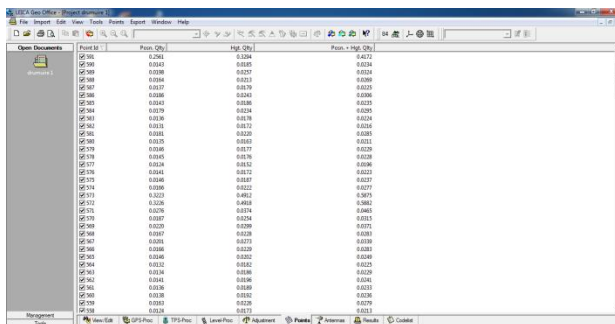
The studied area is in Braşov and surroundings. To highlight the points position they were placed on an image extracted from Google Earth, which was then georeferenced using AutoCAD Civil 3D 2014. The points marked with red represent the RTK points and those with cyan represent the static determined points (Figure 2).

Figure 2. The positioning of the points on the map.

Figure 3. The Frequencies histogram

Figure 4. The Frequencies polygon

Based on the parameters extracted from Leica Geo Office v. 5.0, using Microsoft Excel the frequencies of the values in certain class intervals were determined, and also a series of indicators: central tendency indicators (the arithmetic mean and the median), variability indicators (variance and standard deviation), the quartiles (Q1, Q2, Q3), the minimum and the maximum. Also, using the same program, I realized a series of charts such as the frequencies histogram (Figure 3), the frequencies polygon (Figure 4), the cumulate frequencies polygon (Figure 5), the standard normal distribution chart (Figure 6) and the boxplot chart (Figure 7).

Figure 5. The cumulate frequencies polygon

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Figure 6. The standard normal distribution

Figure 7. The boxplot chart

RESULTS AND DISCUSSIONS

In order to examine in detail the precision of the analyzed methods, each set of parameters was statistically interpreted separately (Table 1).

Because of the fact that the RTK points were measured in different areas and different conditions, the precision values are distant. Therefore, it is necessary to use a differentiated analysis of this data. For this, the parameter set regarding each case (planimetric, altimetric, planimetric+altimetric) was sectioned in several value groups depending on the precision.

In this way the determination of the class intervals was much easier.

In order to determine the distribution type of the data, the frequency of the values in a certain class interval was calculated (Figure 3).

For the data groups that had a normal distribution (Gaussian bell) the experimental curve was determined (Figure 7).

Table 1. Initial data (raw data)

For the data with irregular distribution (Figure 8) the median, the quartiles, the minimum and the maximum were calculated and the boxplot chart was realized (Figure 7), which offers information on the amplitude of data over extreme values, on central tendency (using the median) and on the way the values were grouped (using the quartiles) (Chitea, Petritan, Chitea, 2010).

Figure 8: Irregular distribution

After these calculations were noted:
- the points located in open horizon areas and favorable terrain conditions showed good precision; in terms of planimetry

most points were in the range of 0.014-0.015 m, in terms of altimetry the precision decreases and most of the points is in the range of 0.221-0.230 m, and in terms of planimetry + altimetry most points were in the range of 0.026-0.028 m;

- the points in the hill areas, with relative closed horizon, showed poor precision; in the case of planimetry most points were in the range of 0.150-0.350 m, in the altimetry case most points had a higher frequency in the range of 1.100-2.100 m, and in terms of planimetry + altimetry most points were found in the range of 1.000-1.200 m.

Regarding the static determined points, these points showed a very good precision in all cases (planimetric, altimetric, planimetric + altimetric) regardless the exposition.

- planimetricaly, the points with higher frequencies were found in the range of 0.009 – 0.014 m;
- altimetricaly, most points were found in the range of 0.020 – 0.027 m;
- planimetricaly+altimetricaly, most points were found in the range of 0.024 – 0.032 m.

CONCLUSIONS

Between the two methods used for the determination of geodetic points the most accurate proved to be the static method, providing better results than the RTK method. The only drawback of this method is the long stationary time that is required for the points to be determined.

ACKNOWLEDGEMENTS

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TERRESTRIAL LASERSCANER

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Abstract

In this paper presents new methods for measuring the three-dimensional position of objects with a very high speed embedded in a sensor measurement called LST or Laserscaner land with high resolution and very good accuracy of the 3D positions of object points only few millimeters. Object space is bale beam columns or lines, points so measured in their entirety forming as so-called cloud points.

Keywords: 3D measurement,laserscaner, land measurement, cloud points.

INTRODUCTION

From the point of view of the measurement principle of the LST may be viewed as a polar measurement, which distance is measured with a laser beam, is similar to the total station to measure with a reflector. In contrast however, the LST is not scoring points bezel object, but make a record fully automated raster form surrounding objects without required reflector (Neuner, 2007).

Laser scanning is a new geodetic technique, which can be measured through fully automatic (more or less) the geometry of a structure without a reflective environment, with high precisio)n and high speed (Neuner et al., 2004). The measurement result is represented by a lot (significant) points, called INL specialized in literaturare *cloud points.*

Until now it was once generally accepted definition regarding tools (measuring instruments) that can be considered 3D scanners. Because different technical principles are used to measure the elements needed to calculate the 3D coordinates of a number of

special know tried to define 3D scanners from other instruments based on their own practical way of operating.

This view, among other disadvantages, leading to unnecessary and pointless discussion if 3D scanning and photogrammetry belongs geodetic measurements. For the user, otherwise, the result is the only that matters, regardless of the method used to obtain it.

From his point of view, a 3D scanner is any device that collects the 3D coordinates of the surface of the land or of an object:
- automatically and in a regular pattern;
- with a rate/high frequency (hundreds or thousands of points per second);

The scanner may or may not deliver the scanned surface reflectivity values as the 3D coordinates of additional training.

Current laser scanning technology can be classified into two categories: static and dynamic. The most common method for determining the distance to an object or surface is laser pulse method.

Similar to radar technology that uses radio waves, the distance is determined by

measuring the difference in time between pulse transmission and detection of the reflected signal.

LIDAR technology has application in geology, seismology, remote sensing, atmospheric physics, etc. Another definition for LIDAR include ALSM (Airborne Laser Swath Mapping) and laser altimetry.

The acronym LADAR (Laser Detection and Ranging) is often used in military context. The term is also used laser radar but this term should be avoided because it can create confusion because it uses laser beam or radio waves.

Static laser scanning is defined where the scanner is installed in a fixed position during data acquisition. Advantages of this method are found in preciziar ide results in relatively high density of points.

Laser scanners are still found under the name of terrestrial laser scanners, but there is a clear demarcation between the two concepts. For laser scanning dynamic laser scanner is mounted on a mobile platform.

This platform can be a plane (laser scanning routes) or a moving vehicle. (Neuner et al., 2004). These systems are much more complex and costly, because it works most often in combination with additional positioning systems (INS- Inertial Navigation Systems), (GPS-Global Positioning System).

Terrestrial laser scanner records the three-dimensional points by measuring the horizontal and vertical angle and distance for each spatial point. Distance measurement is electro-optic, in most cases by the process pulse or phase comparison, according to the type of instrument.

Through the use of simple trigonometric functions are obtained coordinates in a cartesian coordinate system's own scanner.

Horizontal and vertical angle are changed automatically with predetermined intervals. (Neuner et al, 2004) .

Recently new instruments have been introduced in the field of surveying that are able to acquire portions of land and objects of various shapes and sizes in a quick and cheap way. (L. Bornaz, F. Rinaudo,2002).

These instruments, based on laser technology, are commonly known as terrestrial laser scanners.

While laser scanner instruments based on the triangulation principle and high degrees of precision (less than 1 mm) have been widely used since '80s, the TOF (Time Of Flight) instruments have been developed for metric survey applications only in the last 5 years. These type of laser scanners can be considered as highly automated total stations.

They are usually made up of a laser, that has been optimised for high speed surveying, and of a set of mechanisms that allows the laser beam to be directed in space in a range that varies according to the instrument that is being used.

For each acquired points a distance is measured on a known direction: X, Y and Z coordinates of a point can be computed for each recorded distance-direction.

Laser scanners allow millions of points to be recorded in a few minutes. Because of their practicality and versatility, these kinds of instruments are today widely used in the field of architectural, archaeological and environmental surveying. (L. Bornaz, F. Rinaudo,2002).

MATERIALS AND METHODS

As mentioned before terrestrial laser scanners can be considered as highly automatic motorised total stations. Unlike total stations however, where the operator directly chooses the points to be surveyed, laser scanners randomly acquire a dense set of points.

The operator only selects the portion of the object he wishes to acquire and the density of the points he desires in the scan (usually the angular step of the scan in vertical and horizontal planes can be selected by the operator). Once these initial values have been choosen, the acquisition is completely automatic.

The result of the laser survey is a very dense points cloud (also called DDSM – Dense Digital Surface Model). For each point of the model the X, Y, and Z coordinates and the reflectivity value are known.

As this set of points is acquired in a completely arbitrary way, with the exception of the parameters imposed by the operator, it is necessary to manage this data in a critical and reasonable way.

Particular attention must be paid to the quality of the original data (L. Bornaz., F. Rinaudo,2002).

The laser scanner data treatment consists of a set of actions that are necessary to obtain the correct digital model of the object, starting from a set of point clouds.

This set of actions can be divided into 2 different stages:

-the pre-treatment (or preliminary treatment) of the laser data;

-the solid modelling of the point cloud.

As "preliminary treatment" we mean all the operations thatare directlycarried outon thepoint cloud, such as, for example, the data filtering (noise reduction), the point clouds registration and georeferencing operations.

The result of these procedures is a complex "noisefree" point cloud (without outliers, gross and systematic errors) and this is the correct starting point for the second stage of the treatment of laser data: the 3D modelling.

The second partof the laser scanner data management, the 3D modelling, is a set of operations that, starting fromany point cloud, allowsa surface model of the object to be formed (L. Bornaz; F. Rinaudo, 2002).

While there is a huge range ofdifferentproducts on the market to carry out solid modelling, just few software for a correct preliminary treatment of terrestrial laser scanner data can be found.

A classification of LST has achieved so far by the principle of measuring distances in surveying applications requiring the principle of impulse and the phase. There are also special distance to the object.

The parameters as scanning speed, maximum distance to the object to be scanned and precision distance measurement, are determined mainly based on the physical principle used to measure distance. In this regard it may be noted that scanners measure the distance on the basis of impulse registered objects at distances much larger than those based on the principle of phase (Neuner,2007; Rabaud,1999).

To compare different products LST, it is also proposed to technical specifications:
- resolution of points scanned at an angle expressed spatial unit number of points/ /steradian;
- beam divergence with respect to the size of the light spot at a certain distance;
- precision 3D form measurement error;
- Scan rate expressed in number of measurements/second. These parameters are required preformed when results scan be statistically analyzed to derive an accurate indicator. In order to achieve the different indicators precision are currently time-consuming calibration, accurate indicators recommended by producers is geared more to the advantageous properties of the sensor. (Neuner, 2007).

Depending on the angle of view (FoV) LST can be classified into three classes:
• scanner type recording chamber;
• scanner wide and hybrid scanners.

Type recording chamber scanners are unable rotation around the main axis of rotation, having a predefined angle of not more than 50 x 50 °. Their field of universal use is restricted, being used especially in works where desired, recording single objects with low spatial expanse. Radius laser scanning object space is cleared of the two rotating mirrors their axes of rotation perpendicular to each other (Neuner, 2007; Rabaud, 1999).

In contrast, hybrid scanners are limited only to the vertical field. To register objects it measures vertical profiles continue executing a rotating scanner head stepping around the vertical axis, provided by a servo-motor. Scan range (Field of View - FoV) is general 360 ° x 60º.

The laser beam is transmitted perpendicular mirror shape polygonal rotatable around a horizontal axis and deviates the beam space. Thus he rises to a vertical projection segment (Neuner, 2007). Scanning laser consists of a laser beam deflection through a mirror (by bale or rotation), the reflection of the laser beam on the surface of the measured object and

receiving reflected laser beam (Neuner 2007; Rabaud, 1999).

Table 1. The clasification of the Land laserscaner depending on the measuring principle

Measuring principle	Measuring the distance by the principle of phase	Measuring the distanceby the principle of momentum
Measuring range	< 80 m	< 1500 m
Measuring precision	< ± 5 mm	> ± 5 mm

Compared to measure distances using a reflective environment, the accuracy of measurement in this situation depend on the intensity of the reflected laser beam (figure 2) functional relationship between precision and intensity are described by the laws of physics (Neuner et al., 2004). The measuring principle was described and is represented in (Figure 1).
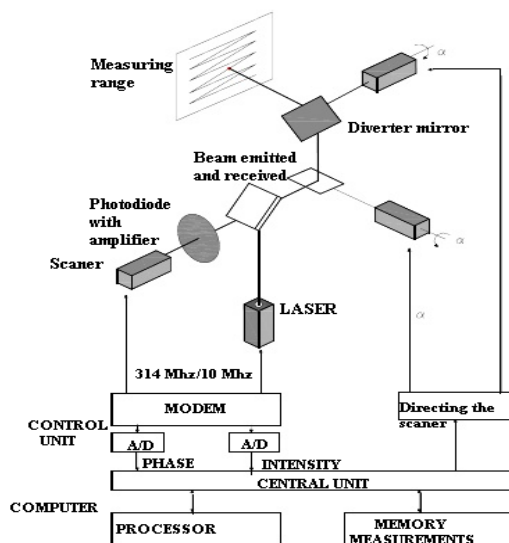
Figure 1. Terrestrial Laser Scanning Principle (Neuner et al, 2004)

The main parameters in this function are the distance from the scanner to the object, the angle of incidence and the reflective properties of the surfaces.
A terrestrial laser scanner, stationary, implies a complex mechanism to measure the two directions of a certain object space.
These lines can be considered to be vertical or horizontal. This principle is suggested in (figure 3). The light beam is emitted by an electronic unit (A) and meets the optic (D), which rotates with very high speed .
On the surface of the optical medium (which has the properties of a mirror) the laser beam is reflected and propagates in a specific angle (ς). When the scanner during the whole profile of the object space, the top of the scanner (C) is rotated by a small angle (α) around the vertical axis, in order to start browsing a different profile, adjacent to the first (Neuner et al., 2004).
The operation is repeated until the completion of all profiles predetermined object of space investigation.
The combination of rotating optics and moving mechanisms of the reflected laser instrument provides the ability to create a uniform network (grid/grid). The measuring principle was described and is represented in (Figure 3).
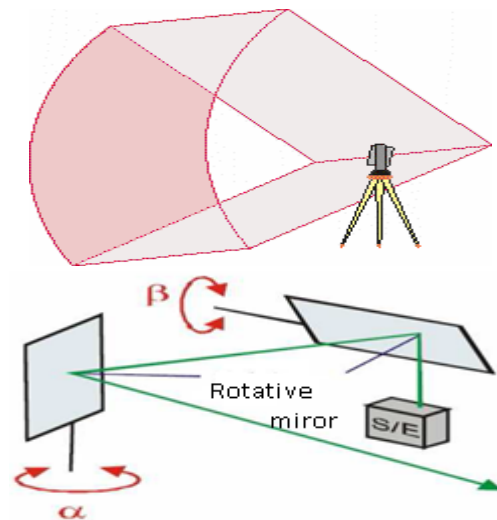
Figure 2. The principle of operation of the scanner type recording chamber (Neuner, 2007)

Description of an object surface is performed by a greater number of points taken (measured), the distance between the points (grid size) may be of the order of millimeters to centimeters. Resolution, or the dimensions of the grid of points describing the surface of an object can be on the order of millimeters panal inches, depending on the position of the instrument (the distance between the points of the station and the object to be scanned), and the inclination of the object surface to the direction of scan.
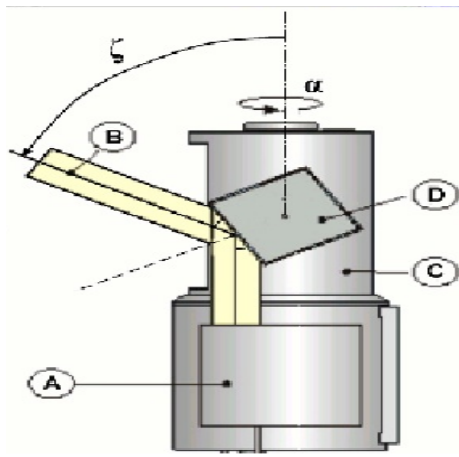
Figure 3. Measuring. Principle (Neuner et al, 2004)

It is important to note that these coordinates are as an internal reference sistem defined by (x,y,z) of the instrument, which the, through georeferencing can be placed in an external coordinate system (X,Y,Z), where necessary (Neuner, 2007).

Compared with records, photogrammetric resolution is much lower, for which there is a tendency to combine the two techniques pickup mass points.

The accuracy of the determination of the spatial position of the points may be on the order of millimeters.

The 3D cartesian coordinates of each measured point are provided through measuring distances, the horizontal and vertical angles.

Most times, with geometric character information (determining 3D coordinates) are provided records of point cloud intensity (radiometric information) and with a built-in photographic camera wich can get a photo of the space object (figure 6).

In this case we can speak even one LIDAR (Light Detecting And Ranging) remote sensing technology defined as optic through which measures properties of scattered light to find range and/or other information about a distant target.

Determination of polar coordinates is accomplished through the laser beam emitted by the device being reflected from the object and measure the distance ,direction and intensity of light reflected in to space. The principle of LST wide was explained and schematic representation can be seen above in (figure 5). In conclusion, we can say that terrestrial laser scanning is a high-resolution

spatial data method for geometric patterns (2D or 3D) data for accurate measurements (Neuner et al, 2004).

The hibrid scaner was described above and can be seen in the (figure 4).
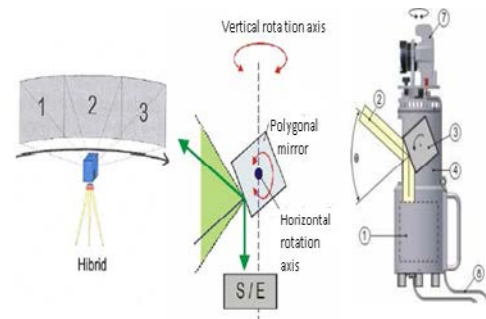
Figure 4. Hybrid Scanner - Riegl 2005 (Neuner, 2007)
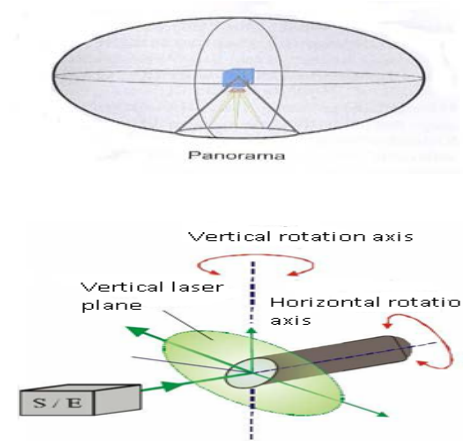
Figure 5. Principle of LST wide(Neuner,2007)
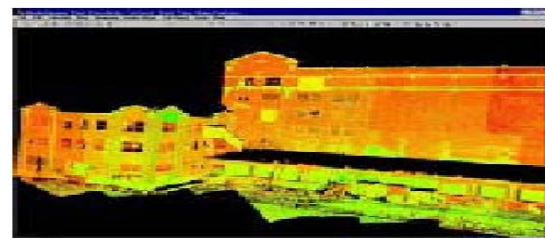
Figure 6. Cloud points with information on the intensity (Neuner et al, 2004)

RESULTS AND DISCUSSION

Panoramic scanners provides a full rotation of the head scan around the main axis of rotation. They have a working vertically almost to complete which is limited only by the bottom surface of the installation tool, to the scanners scanning field (FOV) is 360º x approx. 270º. The laser beam is transmitted horizontally on a surface of a mirror which is inclined at 45 ° to

the horizontal axis of rotation of the mirror. (Neuner, 2007).

This produces a vertical projection plane where is the laser beam. In addition, the

mirror plane is rotated about the main axis. These scanners can be all of the objects recorded in a single scan (Neuner, 2007; Rabaud, 1999).

The notion of " 3D measurement systems " refers to devices that succeed to provide the position, shape and trajectory of an object. The schematic representation can be seen in the (figure 7).

A classification of these systems can be carried out according to the size of which is intended to be registered (position, shape, or path), depending on the physical principle of measurement used (optical or mechanical) function the type of geometric sizes are used (triangulation, trilateration, or hyperbolic method), or the characteristics of the object on which are measurements (eg topography, building facades, car parts, etc.) (Neuner, 2007; Rabaud, 1999).

An important area of measurement technique is to determine position in the kinematic regime. In this case the trajectory of an object is described by a time-dependent position vector and defined in a coordinate system appropriate choice (Neuner, 2007).

Essential in determining kinematic trajectory but the frequency is to be determined by the position of objects to describe as accurately route way.

The frequency is in turn dependent on the speed of movement of the object and precision that is required.

Another characteristic of the process description kinematics could be considered the degree of automation measurement depending on the category of sensors used and the methods of measurement used supported in turn by electronic data recording and processing.

For this point of view, it can make a new classification based on the position of the sensor if it is mounted on the object to be measured or outside it (Neuner, 2007).

All systems use a tighter or wider sense methods for measuring angles and distances.

They can be viewed in close about coordinate systems on which they rely. To this end the apparatus measuring coordinates are only an embodiment of a system for the three-dimensional cartesian coordinates where the coordinates x, y, z are obtained directly from the sensors for measuring the lengths. This can be seen in (figure 7) and is explained above in the text

The tahimeters for example is a embodiment of a spherical coordinate system with angles φ, ω and radius polar R, these quantities are measured directly by the instrument (Neuner 2007; Rabaud, 1999).

The Coordinate systems used in 3D measurements can be seen in the (figure 8)

Figure 8. Coordinate systems used in 3D measurements (Neuner, 2007)

Figure 7. 3D measurement metods (Neuner,2007)
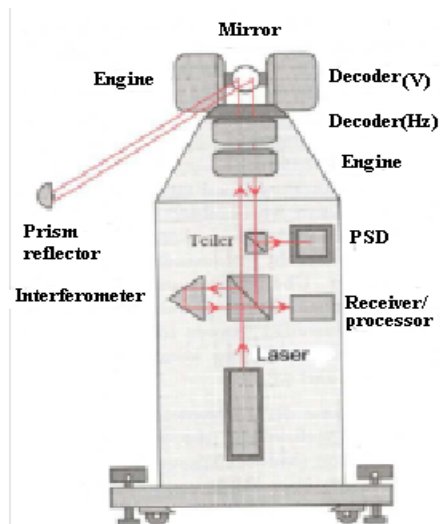
Figure 9. Laser Tracker SMART 310 (Neuner, 2007)

A kinematic measurement system that can track a moving reflector is the SMART 310 manufactured by Leica. Schematic representation of the main components and can be seen in (figure 9)

A laser beam first passes through an interferometer, reaches the rotary dumper mirror and is being diverted to a reflector.

After reflection on the reflector, beam radius reaches back to the interferometer and interferes with the reference beam.

About 70 % of the light reflected by the reflector is directed toward a separating cube in interferometer, which measured changes in reflector distance. The remaining light is directed to a position sensitive diode bright spot (PSD).

Assuming that the beam is reflected in the center reflector, it will get all the PSD center.

A lateral movement of the the prism will lead to a lateral shift of the light spot on the PSD.

Deviations x and y on PSD is a measure of the transverse displacement of the prism to the laser beam.

These is used to calculate signal values of the correction motors (Hz and V), directing mirror roto-tipper so that that beam to drop again reflected center and deviations from the PSD becomes zero.

In this way the laser beam seeks light within certain values. Camera receiver and the system's coordinates are fixed, calculating corrections can take place through the transcalcul coordinates.

The sensor provides two angles (Hz and V) and variance of distance on a reference position of the object space.

These measurements are obtained in polar coordinates, that can be transformed into rectangular coordinates.

These will be initialized at the beginning by routine measurement guidance, as interferometer measures only changes, the distance shall be measured from the beginning at reference distance.

In this sense one could mount a prism in a fixed position even the instrument, the distance position even the instrument, the distance to the primary rotary axis VV instrument being determined by calibration (Home- Point). Another possibility would be to measure a known distance in object space (Neuner, 2007).

CONCLUSIONS

All polar geodetic measuring systems have the disadvantage that do not allow the kinematic measurements than conditioning.

This is due to the time required measurement angles and distances.

In industry and construction sites, however, are increasingly required kinematic measured frequency, which has led to the development of sensors that respond to these requirements.

Terrestrial Laser Scanning is quite legitimately starting to take a larger stake in the domain of mainstream land surveying.

This technological advancement is similar in significance for the industry to what RTK GPS was doing a decade or so ago, and it seems only logical that over the next decade 3D scanning technology will evolve into a main stream tool in the arsenal of most land surveying organizations.

This paper overviews some typical uses where Terrestrial Laser Scanning is changing peoples perceptions of the complexity, accuracy and efficiency in which spatial data can be captured by the modern surveyor.

The use o terrestrial laser scanners for the survey of architectural and natural objects is the most promising techniques in order to achieve quick and complete 3D information.

The data coming from the laser scanner instruments can not be used without a correct approach.

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ASPECTS REGARDING THE EVALUATION OF EXCAVATED VOLUMES FROM CORBII MARI, DÂMBOVIȚA

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Abstract

Through studies and research in this paper was intended to carry out the calculations of volumes of clay excavated from Corbii Mari quarry, Dâmboviţa county, in order to locate and quantify the amount of material excavated from an excavation in case of embankments.
Topographic surveys were made by specialized teams strictly following the steps of obtaining the topographic plan: enriching the support network, obtaining the levelling network and obtaining the topographic plans.
The measurements followed by office calculations performed by automated methods and through dedicated software will determine the volumes of the amount of sterile soil respectively the amount of extracted clay.

Key words: evaluation, excavated, quarry

INTRODUCTION

„In mining and excavation works, volume calculation is extremely important both in terms of geodesic and economically. First, excavation has more variables and unknowns — you don't know what's down there until you start digging; second, you have to rely on information from many sources — some of which may not be accurate "(Fodor D., 1980). The aim of this paper is to highlight the differences between working methods and the differences that we have achieved and also to calculate excavated volumes of earth, sand, ballast and refusal sieve. „Depending on the construction and the location of excavation is necessary to establish the technical solutions that protect neighborhoods, reducing the risks associated with deep excavations to a minimum acceptable" (Ortelecan M., 2006). The works were held in Dâmboviţa County, at Corbii Mari quarry (Figure 1).

Figure 1. Orthophotomap of the quarry

The acceptable limit is, however, difficult to estimate, requiring complex investigations of the site and then modeling of the overall support structure to estimate its behavior and impact on neighborhoods.
Geotechnical investigations were carried out in several stages. In the first phase there have been completed three drilling: two drillings of 45 m depth and one of a 60 m depth. From these drillings there were taken samples for laboratory tests carried out with simultaneous

penetration of SPT type (Small Precision Tools). The drillings of 45 m were additionally equipped with piezometers for hydrogeological analysis of the site.

Calculation methods have been developed along with technology, especially as the calculation of the excavated materia is an operation too difficult or has inaccurate results by classical methods. One of the classical methods of calculating volumes is truncated pyramid method. This method consists of construction of fixed transversal profiles on the embankments.

It is calculated the area of the simple geometrical figures formed by the profile before and after the excavation and measuring the depth of excavation and the distance between two or more profiles, reaching the volume of excavated material. It is a laborious work that has to be treated with attention and a lot of working time. But nowadays the technology explosion and informatics which made daily advances help us perform these calculations with higher precision and much faster by many software and specialized programs.

MATERIALS AND METHODS

To facilitate the measurements around the quarry area there were built a network of 6 points whose coordinates were determined with high precision and were materialized in the ground by concrete terminals. The orientation point was Cioaba point. Surveying was done by traverse combined with radiation method and with the help of state geodetic network with points determined with high precision we were able to verify all measurements and to reduce errors. Drilling points were made by the method of radiation.
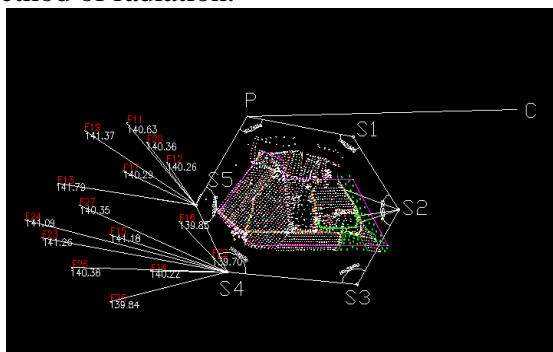
Figure 2. Traverse method combined with radiation

The equipment that was used to make the measurements was the Sokkia 630-R total station (Figure 2).

Table 1. Coordinates of the network points around the quarry

Point	X	Y
C	339405,33	544411,66
P	339357,299	542439,434
101	339209,05	543212,83
102	338682,14	543546,72
103	338143,68	543243,84
104	338235,28	542287,95
105	338715,45	542062,88

Regarding the office stage, the data were downloaded from the total station and using them we made a topographical plans. Using specialized software, 3D terrain model was made which showed us the real situation of land during the time which we analyzed the amount of excavated material.

The software we used for the analysis of volume calculations are:

-AutoCAD 2007- TopoLT
-Surfer v 9.8

RESULTS AND DISCUSSIONS

By creating 3D models in the two softwares we wanted to track the most accurate software in assessing and quantifying the volume of excavated material. Measurements were performed in two phases: 2008 and 2009 on the two lakes. After the representation of the points in the two softwares was performed the longitudinal profile, transversal profile and topographic plan at 1:2000 scale. The 3D models were made in both ages in AutoCAD-TopoLT and Surfer 9 (Figure 3, Figure 4), with the aim to follow differences between the two softwares in the way that they shows the terrain after excavations.

With these two softwares we obtained the following 3D models:

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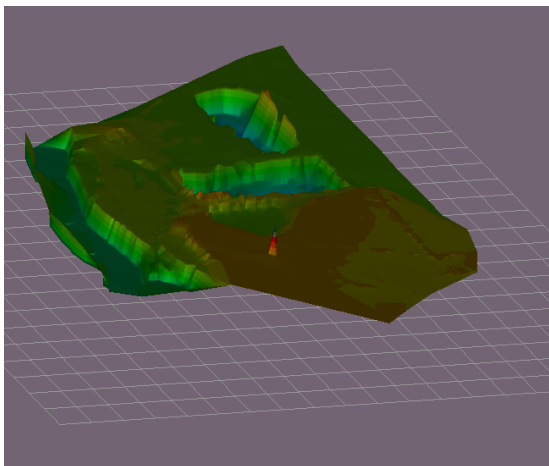
Figure 3. The AutoCAD-TopoLT 3D Model
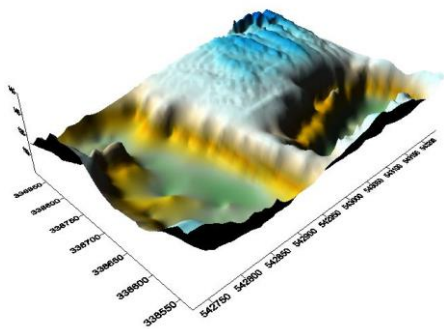
Figure 4. The Surfer 9 3D Model

In TopoLT for the volume calculation, the program automatically overlap the chosen 3D Model and calculates the cut & fill volumes (Figure 5, Figure 6.)
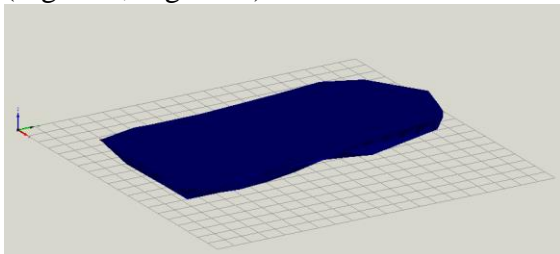
Figure 5. AutoCAD-TopoLT, Lake 1
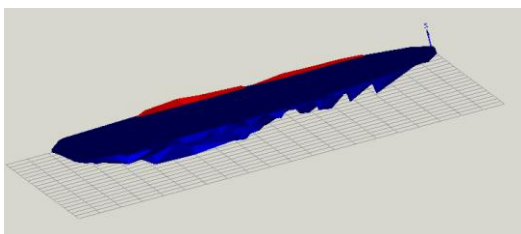
Figure 6. AutoCAD-TopoLT, Lake 2

In Surfer 9 the volumes were calculated by two rules: the trapezoidal rule and the Simson`s rule (Figure 7, Figure 8). With the Surfer version 9 we created a grid file which one we could create the 3D Model and then we calculated the volumes (Table 2).
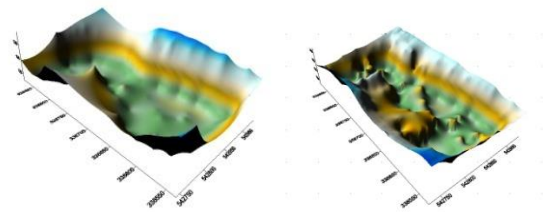
Figure 7. Surfer 9, Comparasion of the Lake 1 in two ages
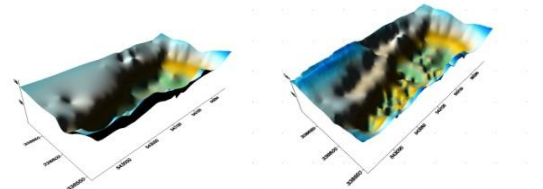
Figure 8. Surfer 9, Comparasion of the Lake 2 in two ages

Table 2. Results of the volume calculation

Software	Cut	Fill	Cut+Fill	
AutoCAD-TopoLT	214414.8 8 mc	76247.26 mc	290662.1 4 mc	
Surfer 9	218445.7 8 mc	76850.52 1 mc	295296.7 1 mc	

CONCLUSIONS

Between these two softwares the most precise is the AutoCAD TopoLT because it makes the 3D Model using a triangulated network. The volume calculation result that we have obtained using Surfer program are not very accurate as the results from TopoLT.

Surfer allows the evaluation of data using the 3D model, the vectorial model and level curves. It is easy to use because it has the Excel worksheet. Instead TopoLT AutoCAD has many tools for processing data and allows to overlap the 3D Models.

ACKNOWLEDGEMENTS

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***http://www.topolt.com/

COMPARATIVE STUDY OF BASIC GEODETIC PROBLEMS SOLVED ON THE ELIPSOID AND SPHERE

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Abstract

This paper aims to present a comparative study of basic geodetic problems solved on the ellipsoid or sphere. The basic geodesic problem refers to the geographic coordinate system that consists of ellipsoidal: geodesic problem direct and inverse geodesic problems. Thus, using direct geodetic problem is calculated coordinates of geodesic points forming a network of the geodesic and geodesic inverse problem element is calculated initial surveying , those distances and azimuth , and verify the calculations made at the geodesic problem directly. The ultimate goal of the calculations performed on the reference ellipsoid is the determination the coordinates of the points of the geodetic networks of support. There are several ways of solving the basic geodetic and this diversity was conditioned by the need to decrease the volume, increase the accuracy of the final results, even in terms of geodetic distances, as well as by means of calculation under consideration at your disposal.

Key words: Ellipsoid, Inverse problem, Direct problem, Sphere, Geodetic problems solved

INTRODUCTION

Geodetic measurements are effectuated on the physical surface of the Earth which is a complex and not at all plain surface (Dima, 2005).

For obtaining unitary coordinates of points belonging to the geodetic network support, these measurements must be related to a unique surface.

After some extensive research it had been established that this surface may be taken as the quiet surface of the oceans and seas imaginary prolonged beneath the continents, and the solid that is made out of this figure is called geoid. The surface that approximates best the geoid, is the rotation ellipse with low flatting at poles.

The rotation ellipse is a mathematical figure generated by spinning a meridian ellipse around the pole axis (Figure 1).

For small surfaces, the rotation ellipse may be assimilated with the sphere of medium radius, which presents facilities in mathematical operation effectuation.

Solving the first order triangulation networks is performed on the reference surface. Following the triangulation network points to be given by geodetic coordinates B, L or geographic coordinates φ and λ.

Geodetic latitude and longitude coordinates are commonly measured in degrees, minutes, and sexagesimal seconds (Postelnicu, 1980).

The ellipsoidal altitude (HE) or elevation has two components: orthometric altitude, denoted by HORT, which represents the height of point measured by leveling the surface from the geoid and geoid undulation, denoted by N, which represents the height of the geoid from the ellipsoid surface (http://www.scrigroup.com/geografie/geologie/ suprafete-de-referinta21138.php).
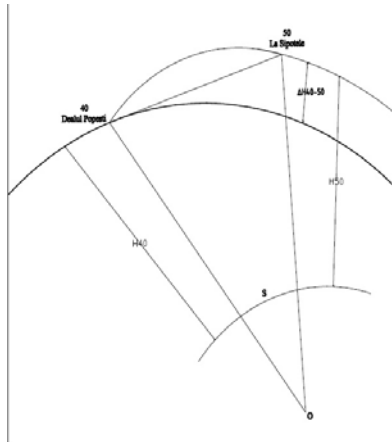
Figure 1. Projection on the ellipsoid

MATERIALS AND METHODS

The state geodetic network consists of high-order triangulation points (I, II, III) and low-order triangulation points (IV, V). This network is presented as a compact network of triangles combined with quadrilateral shapes with both diagonals observed, having scientific and practical purpose (Ortelecan, 2006).

The first order network has points arranged in triangle shape, equilateral if possible, assuring a medium sides length of 25 – 30 km (Manualul inginerului geodez, 1973).

Azimuth and zenith observations for triangulation networks of I and II order are performed with high precision theodolites which have reading accuracy of 0.3 and 0.5 seconds, and the measurement method used is the binary series method (The Schreiber method). Generally for measuring first order network angles, there are used Wild T4 and Wild T3 (Figure 3). In networks of II, IV and V order, there are used Wild T2, Zeiss Theo 010A and B with a precision of 0.2 seconds (Figure 2).

Figure 2. Theo 010A and B

Figure 3. Theodolit Wild T2
(http://google imagine.com)

RESULTS AND DISCUSSIONS

The final purpose of the calculations effectuated on the reference ellipsoid is the determination of the geodetic coordinates; latitude B and longitude L, of points belonging to the geodetic networks support. The rigorous processing operations of astronomical-geodetic determinations claims the calculation of geodetic coordinates in several phases: the calculation of temporary coordinates, necessary in the preliminary stage of rigorous processing and final coordinates calculation, after completion of proper compensation. Therefore it can be appreciated that this type of calculations hold an importantly distinguished volume, reason for they are recognized in the specialized literature as basic geodetic problem solving(http://www.acpi.ro/pages/wiki.php?lang=ra&pnu=transformariCoordonate).

The first basic geodetic problem, known as direct geodetic problem, consists of determining geodetic coordinates B2, L2 of point S2 and geodetic azimuth A2, known as inverse geodetic azimuth, according to B1, L1 coordinates of point S1, geodetic azimuth A1, known as direct geodetic azimuth, and length of geodetic line s between points S1, S2 (Figure 4).

The succesive use of direct geodetic problem is known as coordinates transit (Figure 5).

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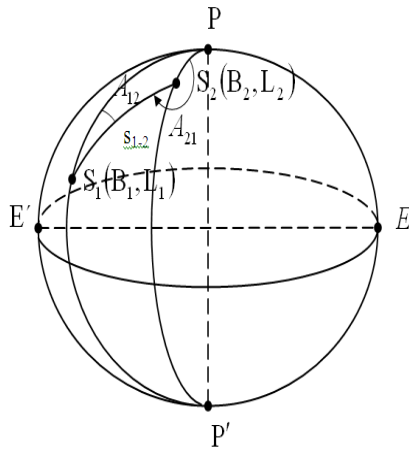
Figure 4. Representation on the ellipsoid

$$cos\frac{a}{2}cos\frac{B+C}{2}=cos\frac{b+c}{2}sin\frac{A}{2}$$

$$cos\frac{a}{2}sin\frac{B+C}{2}=cos\frac{b-c}{2}cos\frac{A}{2}$$

4.Adaptation of angles from trigonometric relations with tohse from the spheric triangle from the example before us (Table 1);

Table 1. Elements of the triangle

$A = A_1$	$a = 90^0 - B_2$
$B = 180^0 - A'_1$	$b = 90^0 - B_1$
$C = L_2$	$c = s'$

Known data :

B1 = 46^0 49' 19'',5088

L1 = 23^0 33' 07'',50596

A1 = 46^0 38' 41'',8937

s = 13549.88851 m

Required:

B2= ?

L2= ?

A'1= ?
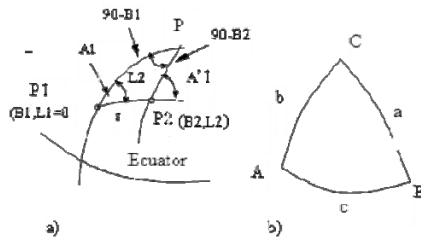
Figure 5.Direct geodetic problem

Calculation steps :
1.Transformation of sexagesimal minutes and seconds in decimal degrees;
2. Transforming the geodetic length in radians;
3. Using spherical trigonometry relations of Delambre;

$$sin\frac{a}{2}cos\frac{B-C}{2}=sin\frac{b+c}{2}sin\frac{A}{2}$$

$$sin\frac{a}{2}sin\frac{B-C}{2}=sin\frac{b-c}{2}cos\frac{A}{2}$$

$$\frac{B-C}{2}=\frac{180^0-A'_1-L_2}{2}=90^0-\frac{A'_1+L_2}{2}$$

$$\frac{b-c}{2}=\frac{90^0-B_1-s'}{2}$$

$$\frac{B+C}{2}=\frac{180^0-A'_1+L_2}{2}=90^0-\frac{A'_1-L_2}{2}$$

$$\frac{b+c}{2}=\frac{90^0-B_1+s'}{2}$$

5.Coordinates calculation of point S2 with Delambre relations;

I

$$sin\frac{90°-B_2}{2}sin\frac{A'_1+L_2}{2}=sin\frac{90°-B_1+s'}{2}sin\frac{A_1}{2}$$

II

$$sin\frac{90°-B_2}{2}cos\frac{A'_1+L_2}{2}=sin\frac{90°-B_1-s'}{2}cos\frac{A_1}{2}$$

III

$$cos\frac{90°-B_2}{2}sin\frac{A'_1-L_2}{2}=cos\frac{90°-B_1+s'}{2}sin\frac{A_1}{2}$$

IV

$$cos\frac{90°-B_2}{2}cos\frac{A'_1-B_2}{2}=cos\frac{90°-B_1-s'}{2}cos\frac{A_1}{2}$$

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By dividing relations I and III to II and IV results :

$$tg\,\frac{A_1' + L}{2} = \frac{\sin\dfrac{90° - B_1 + s'}{2}}{\sin\dfrac{90° - B_1 - s'}{2}}\,tg\,\frac{A_1}{2} =$$

$$= 0,433453699$$

$$tg\,\frac{A_1' - L}{2} = \frac{\cos\dfrac{90° - B_1 + s'}{2}}{\cos\dfrac{90° - B_1 - s'}{2}}\,tg\,\frac{A_1}{2} =$$

$$= 0,430771149$$

$A_1' + L = 2\text{arctg}\,0,433453699 =$
$= 46,86899742$

$A_1' - L = 2\text{arctg}\,0,430771149 =$
$= 46,60996646$

$A_1' = 46°.73948194 = 46° 44' 22'',13498$
$L = 0°.129515482 = 0° 07' 46'',25573$
$L_2 = L_1 + L = 23.55208 + 0.129515482 =$
$= 23° 40' 53'',76169$

$$tg\,\frac{90 - B_2}{2} = \frac{\sin\dfrac{A_1' - L}{2}}{\sin\dfrac{A_1' + L}{2}}\,tg\,\frac{90 - B_1 + s'}{2} =$$

$$= 0,394862831$$

$$tg\,\frac{90 - B_2}{2} = \frac{\cos\dfrac{A_1' - L}{2}}{\cos\dfrac{A_1' + L}{2}}\,tg\,\frac{90 - B_1 - s'}{2} =$$

$$= 0,394862831$$
$90 - B_2 = 2\arctan 0,394862831 = 43,09444$

$B_2 = 90 - 43.09444 = 46.90555779 =$
$= 46° 54' 20'',00804$

The second basic geodetic problem known as inverse geodetic problem consists of determining the length of geodetic line s and geodetic inverse and direct azimuth A1 and A2, when the geodetic coorindates of points S1 and S2 are known (Figure 6).
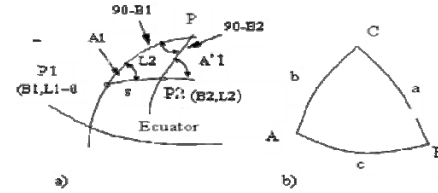
Figure 6. Inverse geodetic problem

Known data :

$B1 = 46° 49' 19'',5088$

$L1 = 23° 33' 07'',50596$

$B2 = 46° 44' 19'',00879$

$L2 = 23° 40' 53'',03729$

Se cere:

A1 = ?

A'1 = ?

s = ?

Calculation steps:
1. Transformation of sexagesimal minutes and seconds in decimal degrees (Table 2);
2. Adapting the angle values from trigonometric sexagesimal relations with those from the spheric triangle from the example before us;
3. The use of Delambre relations from spherical trigonometry;
4. Calculating the direct azimuth, inverse azimuth and the geodetic line (Table 3).

1.

Table 2. Measured elements

Coord.geod.	Grade [°]	Minute [']	Secunde ["]	Grade decimale
B1	46	49	19,5088	46,82208578
L1	23	33	07,52596	23,55208499
B2	46	44	19.00879	46,73861355
L2	23	40	53.03729	23,68139925
L= L2 - L1	0	7	45,53133	0,129314258

2.

Table 3. Elements of the triangle

$A = L2$	$a = s'$
$B = 180^0 - A'_1$	$b = 90^0 - B_1$
$C = A1$	$c = 90^0 - B_2$

$$\frac{B-C}{2} = \frac{180^0 - A'_1 - L_2}{2} = 90^0 - \frac{A'_1 + L_2}{2}$$

$$\frac{b-c}{2} = \frac{90^0 - B_1 - s'}{2}$$

3.

$$\frac{B+C}{2} = \frac{180^0 - A'_1 + L_2}{2} = 90^0 - \frac{A'_1 - L_2}{2}$$

$$\frac{b+c}{2} = \frac{90^0 - B_1 + s'}{2}$$

I

$$\sin\frac{s'}{2}\sin\frac{A'_1 + A_1}{2} = \cos\frac{B_2 + B_1}{2}\sin\frac{L}{2}$$

II

$$\sin\frac{s'}{2}\cos\frac{A'_1 + A_1}{2} = \sin\frac{B_2 - B_1}{2}\cos\frac{L}{2}$$

III

$$\cos\frac{s'}{2}\sin\frac{A'_1 - A_1}{2} = \sin\frac{B_2 + B_1}{2}\sin\frac{L}{2}$$

IV

$$\cos\frac{s'}{2}\cos\frac{A'_1 - A_1}{2} = \cos\frac{B_2 - B_1}{2}\cos\frac{L}{2}$$

4.

$$tg\frac{A'_1 + A_1}{2} = \frac{\cos\frac{B_2 + B_1}{2}}{\sin\frac{B_2 - B_1}{2}}tg\frac{L}{2} = 1,060880686$$

$$tg\frac{A'_1 - A_1}{2} = \frac{\sin\frac{B_2 + B_1}{2}}{\cos\frac{B_2 - B_1}{2}}tg\frac{L}{2} = 0,000822362$$

$A'_1 + A_1 = 2 arctg\ 1,060880686 = = 93.38417667$

$A'_1 - A_1 = 2 arctg\ 0,000822362 = = 0,094235716$

By solving the sistem the result is:
$A'_1 = $ (93.38417667+0,094235716)/2 = $46^{0.}7392062 = 46^0\ 44'\ 21",14230277$
$A_1 = $ (93.38417667- 0,094235716)/2 $= 46^0.64497048 = 46^0\ 38'\ 41",89372535$

For calculating the length of the geodetic line, relation I is divided by relation III, and for verification, divide relation II by IV.

$$tg\frac{s'}{2} = \frac{\sin\frac{A'_1 - A_1}{2}}{\sin\frac{A'_1 + A_1}{2}}ctg\frac{B_2 + B_1}{2} = 0,001061981$$

s' = 2arctg0,001061981= 0,00212396
s = s'R=13549,88851 m

$$tg\frac{s'}{2} = \frac{\cos\frac{A'_1 - A_1}{2}}{\cos\frac{A'_1 + A_1}{2}}tg\frac{B_2 - B_1}{2} = 0,001061981$$

s' = 2arctg0,001061981= 0,00212396

s = s'R=13549,88851 m

There are known several procedures of solving basic geodetic problems. This diversity was conditioned by continuos necessity of math movement volume, of increased accuracy for the final results, even in large geodetic distances, such as available means of calculation.

Nowadays some of the procedures, know a reduce applicability, for example the ones that are based on logarithm usage, such that would not be used in the present paper.

There are several classification criteria of the methods and procedures of geodetic coordinates calculation on the reference ellipsoid, according to the principal element within these calculations. One of the current classification criteria used, accepted within this paper, regards as principal element the length of the geodetic line *s*. From this point of view it can be distinguished: solving methods for short geodetic distances (s<60 km), medium distances (60< s < 600 km), and long distances (s>600 km). Within these three methods there will be presented those solving procedures which have historical priority or know a current applicability in the geodetic use.

Because the necessary formulas used for solving inverse geodetic problems are acquired from the formulas used for solving direct

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geodetic problem, by applying suitable mathematical transformations (for example developmental reversals in sequence), will present further the deduction principles of formulas just for the direct geodetic problem, nevertheless numeric formulas and examples will be presented for solving both basic geodetic problems.

Among the areas where are involved solutions of basic geodetic problems we can mention: achievement of support geodetic network by the first order (where appears short geodetic distances, on an average of 30-40 km), of continental and intercontinental geodetic network(medium geodetic distances), air navigation problems, missile technic,(long geodetic distances). Basically the problem begins with the calculation of the distance and geodetic azimuth between the points of knowing coordinates, placed at large distances, tens of thousands of kilometers, such that the application in solving basic geodetic problems are nelimitated. Another problem that needs to be solved is the calculation precision of geodetic coordinates, distinguishing exactly and approximately methods. As the geodetic distances grow, the exactity in calculations has special meanings. As well as other geodetic calculation, the basic geodetic problem follows that the calculation errors to be 10 times smaller than medium errors wich characterized the field opperations. Thereby, can be showed that in gedetic triangulation of I order is necessary that the approximation of calculation for the geodetic coordinates B and L to be $\pm 0'',0001$, also for geodetic azimuths A, $\pm 0^{cc},001$, and for geodetic distances s, $\pm 0,001$ m. These type of aproximations will be exagerated in the moment when geodetic distances are at the point of hundreds of kilometers, that were determined with radar apparatus, in this case the fields errors are higher. As soon as the laser technic of distances determination will be improved and also the processing methods(in special precise deduction on ellipsoid surface, based on knowing geoid profile) solving basic geodetic problems with a higher precision when are met medium and large geodetic distances. (Ghiţău et al., 1997)

CONCLUSIONS

Determining the minimal distance between two points of the ellipse, as a mathematical figure of the Earth, it presumes a very laborious calculation. The results obtained by this method are more accurate, so more closer to the true value. Also, modern navigation systems (GPS, DGPS) use as a mathematical form of the earth, the ellipse (WGS 84).

While calculations on the sphere are more simplified that those on the ellipse.

For example for executing small-scaled maps, the globe may be assimilated with a sphere, because if it will be considered a sphere with a equatorial radius of 15 cm, the polar radius will be 0.5 mm smaller than the equatorial one, therefore negligible. For this reason, in practical cartography problems, the globe will be considered a sphere. For calculating length of the geodetic line smaller than 60 km, the formulas assure precision of 1 mm for length s and $0'',001$ for azimuth A. Calculation of geodetic-geographic coordinates on the ellipse represent a basic geodetic problem of triangulation and trilateration of first orded. For the other orders, calculations are performed on the projection planes.

The direct and inverse geodetic problem serve for the mutual control, the results must coincide in the approximation of: $0'',0001$ for geodetic coordinates, and $0'',001$, for azimuth's A, and 0.001 m for length's s.

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COMPARATIVE ANALYSIS OF THE RESULTS OBTAINED FROM SOLVING SMALL SPHERICAL TRIANGLES THROUGH LEGENDRE METHOD, AND THROUGHSOLDNER METHOD

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Abstract

The observation executed on the topographical surface in the points of the triangulation network are projected on the reference surface which is the ellipsoid of rotation.The ellipsoid of rotation can be approximated with a sphere of avarageradius.The triangulation networks of first order are always solved on the reference ellipsoid or on the sphere of medium radius.Legendre and Soldner created two methods of solving the small spherical triangles using relations from the plane trigonometry to make easier the calculation.The comparison of the obtained results through this two methods was realized for triangulation points form Cluj county.

Key words: ellipsoid, Legendre, Soldner, triangles spherical.

INTRODUCTION

The geodesic triangulations are formed by ellipsoidal triangles, so they are defined on the surface of the reference ellipsoid.

The side lengths of the triangles vary between $30 \div 50$ kilometres and rarely get to 60kilometres in the case of the first order geodesic networks.

Because on relatively small surfaces, the reference ellipsoid can be approximated with a sphere of medium radius, solving the ellipsoidal geodesic triangles can be reduced to solving some spherical triangles. (Ortelecan, 2006).

Solving this problem means calculating the sides length of the triangles from the triangulation network starting from a known side and having all the angles of the triangle determined.

When solving the spherical geodesic triangles it is not recommended to use the known formulas of the spherical trigonometry, because the spherical excess (the plusses over 200^g) have small values.(Ghiţău, 1983).

MATERIALS AND METHODS

The Optical Micrometer Theodolite Theo 010 (Figure 1) is suited for all geodetic work. The principal application of the instrument was for triangulations of 2nd to 4th order, precision traversing (above and below ground).

The instrument is compact and completely self-contained. The accuracy of Theo 010 is 2". (M. Neamţu et al., 1982).

The horizontal and vertical scale intervals of the micrometer is 1". The altitude bubble sensitivity is 20"/2mm. The circles have double line graduations, the actual division being between the two lines. By turning the micrometer head, the circles apparently move in opposite directions until the upper and lower double lines are made to coincide.

For this purpose, adequate special methods are going to be used, namely:
- Soldner method (the method of the additaments);
- Legendre method (the method of the developments in series).

Figure 1 - Theo 010

Legendre Method (Developments In Series)

The Legendre method is one of the most used methods when solving the small geodesic triangles. The method is based on the usage the following considerations:
Considering the sides of the spherical triangle equal with the sides of the plane triangle , the angles of the spherical triangle must be offset with 1/3 of the spherical excess. So the small spherical triangles are going to be solved by applying the plane trigonometry formulas.(Dima, 2005)
The steps of solving the small spherical triangles are :
1. Calculation of the spherical excess
2. Offseting the angles of the spherical triangle
3. Calculation of the angles of the plane triangle by correcting the angles with 1/3 of the spherical excess
4. Calculation of the sides by applying the sinus theorem from the plane triangle

Soldner Method(Aditamentelor)

Aditamentelor method. With Aditamentelor method, which was introduced by J.G. Soldner in 1810, any small ellipsoidal triangle (the triangle located on the average Gauss sphere) is solved by a plane triangle, whose angles are equal to those of the ellipsoidal triangle, but the triangle side will change with calculable values, which are called aditamente.(Dima, 2005)
Calculation algorithm :

· The calculation of spherical excess;

· The empirical processing of the angles in the parallel spherical triangle

· The calculation of the first side in the intermediary plan triangle: $a' = a - A_a$, whereA$_a$is called aditament for the a side and it is determined with the equation $A_a = \dfrac{a^3}{6R^2}$.

RESULTS AND DISCUSSIONS

Legendre Method
To solve the small triangle ellipsoid using the Legendre we need as known elements the angles 40 , 48, 219 and side "40" measured (figure 2) and reduced on ellipsoid surface and we have to determine other sides 48, 218 of the small ellipsoid triangle (Table 1).

Table 1. Coordinates of the geodetic triangulation network on the administrative territory of
Cluj-Napoca

Designation point	Point no.	X	Y	Z
Dl Popesti	40	592373.84	389535.84	682.40
Dl Soporului	48	584577.58	397156.93	459.07
La Bazin	219	584181.45	391671.64	485.98

Calculation algorithm:
Excess spherical ε^{cc}
$$\varepsilon^{cc} = (\alpha) + (\beta) + (\gamma) - 200^g$$

- calculation of excess spherical ε^{cc} for small elipsodic triangle . Of which tips are denoted 40, 48, 219.
- processing empirical angle in spherical triangle coresondent applying the principle of equal influence of measurement errors on the three angles:

$40° + 48° + 219° = 200^g + \varepsilon^{cc} + \omega$.
Where with ω noted the total error of measurement of the three angles.
$\omega = 40° + 48° + 219° - (200^g + \varepsilon^{cc})$.
Based on this principle, the three angular corrections will be equal to each other
$$v'_{40} = v'_{48} = v'_{219} = -\frac{\omega}{3}$$

so that they can obtain preliminary processed angles spherical triangle

$$40 = 48° - \frac{\omega}{3};$$

$$48 = 48° - \frac{\omega}{3};$$

$$219 = 219° - \frac{\omega}{3}.$$

The sum of these angles will be:
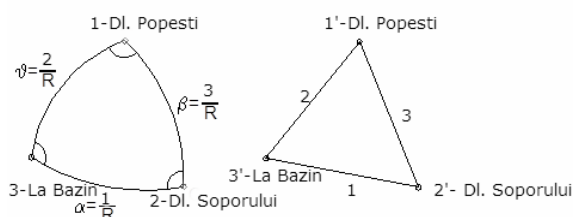$$40 + 48 + 219 = 40° + 48° + 219° - \omega = 200^g + \varepsilon$$
.

Figure 2 - Solving small ellipsoidal triangles through Legendre theorem

➤ angles calculation (processed provisional) in the inermediate plan triangle (auxiliary) in accordance with the theorema Legendre:

$$40'=40-\frac{\varepsilon^{cc}}{3};$$

$$48'=48-\frac{\varepsilon^{cc}}{3};$$

$$219'=219-\frac{\varepsilon^{cc}}{3}.$$

Sum of the angles in the triangle interimediate plan will be :
$$40'+48'+219'= 40 + 48 + 219 - \varepsilon^{cc} = 200^g.$$

➤ intermediate triangle solving plan in which the sum of the angles fulfills the condition can be achieved by known theorem from the plane trigonometry:

$$\frac{40}{\sin 40'} = \frac{48}{\sin 48'} = \frac{219}{\sin 219'}$$

If the magnitude established is noted:
$$modul = \frac{40}{\sin 40'}.$$

results sides 48 and 219, identical in triangle plan and in small ellipsoid triangle:
48 = modul sin 48';
219 = modul sin 219'.(Table 2)

Table 2. Calculation of the triangle sights lengths of small ellipsoid triangle with Legendre method

Triangle peak	Angle measured	Corection -ω/3	Offset angle in the small ellipsoidal triangle	Corection -ε/3	Offset angle in the plane triangle	Sine of the angle in the plane triangle	Module	Length of the edge in the plane triangle and in the small ellipsoidal triangle	Name of the edge
40	33.04158	0.118927712	33.16050771	-0.119381045	33.04112667	0.496019715		5499.575016	48-219
48	55.31308	0.118927712	55.43200771	-0.119381045	55.31262667	0.763586047		8466.193217	40-219
219	111.6467	0.118927712	111.7656277	-0.119381045	111.6462457	0.98331331	11087.4122	10902.39995	40-48
				[]	200				

Soldner Method
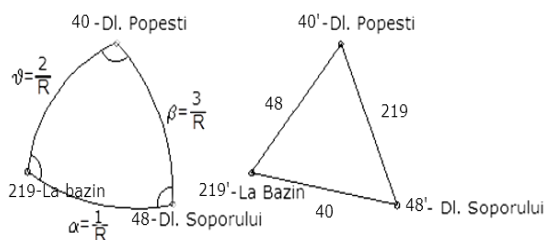
Figure 3 - Solving small ellipsoidal triangles with theorem Soldner

Solving triangle intermediate plan in which are known: side a and all three angles $40' \equiv 40$; $48' \equiv 48$; $219' \equiv 219$, also by using known theorems of plane trigonometry:
$$\frac{40'}{\sin 40} = \frac{48'}{\sin 48} = \frac{219'}{\sin 219}.$$

Is denoted like the Legendre method:
$$Modul = \frac{40'}{\sin 40},$$
48' = Module sin 48;
219' = Module sin 219 (Figure 3)
Calculation side 48 and 219 in the little ellipsoid triangle:
$$48 = 48'+1_2,$$
$$219 = 219'+1_3;$$

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where:

$$1_{48} = \frac{(2')^3}{6R^2}.$$

$$1_{219} = \frac{(3')^3}{6R^2};$$

As shown, in calculating aditamentelor 1_{48} and 1_{219} were used sides 48' and 219' from intermediar plan triangle not the sides 48 and 219 from small ellipsoidal triangle,(Table 3) approximation is allowed to sides less than 100 km.

It can be shown that through calculation of aditamentelor in the case of small ellipsoidal triangles (s < 60 km) is enough to the mean for total curve $K = \frac{1}{R^2}$, for territories covering a large area with 5° latitude north and south respectively (about 1000 km in total on the north - south). For our country that meets the condition referred and where $48_{medium} = 46°$, it can be used:

$$R = R_{46°} \approx 6378957 \text{ m},$$

which $\frac{1}{R^2} \approx 4.0959 \cdot 10^{-15}$.

Table 3. Calculation of small ellipsoidal triangle sides lengths with Legendre method

Name side	Value side
48-219	5499.575016
40-219	
40-48	
(48-219)'=	5499.574335
Module=	11087.27257
(40-219'=	8466.137613
(40-48)'=	10902.24833
40-219	8466.140098
40-48	10902.25364
Name side	**Value side**
48-219	5499.575016
40-219	8466.140098
40-48	10902.25364

CONCLUSIONS

It can be seen that the results obtained through the Legendre's method and Soldner's method are approximately equal, the differences are insignificant and it can be showed the results of the coordinates of in the next table (Table 4).

Table 4. Side differences obtained from the two methods of calculation

Methods	Side lenght in the plan triangle and little ellipsoid triangle [m]	Side name	Differences between methods
Legendre method	5499.575016	48-219	0
	8466.193217	40-219	0.053118725
	10902.39995	40-48	0.146309453
Soldner method	5499.575016	48-219	
	8466.140098	40-219	
	10902.25364	40-48	

ACKNOWLEDGEMENTS

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DEVELOPMENT ANALYSIS OF THE TIMISOARA BASED ON SATELLITE IMAGES

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Abstract

In this paper it is studied the development of Banat's University of Agricultural Sciences and ''King Michael I of Romania '' Veterinary Medicine between the years of 1987 – 2013 based on images taken from earth satellite. The analysis of this images are made using a program called ArcGIS. With the use of this program was obtained six normalized differences indexes and two combinations of spectral bands; in which it is possible to see how the area of USAMVB Campus had developed in 26 years.

Satellite imagery consists of images of Earth or other planets collected by artificial satellites.

Interpretation and analysis of satellite imagery is conducted using specialized remote sensing applications. Remote sensing refers to the use of aerial sensor technologies to detect and classify objects on Earth (both on the surface, and in the atmosphere and oceans) by means of propagated signals (e.g. electromagnetic radiation). Satellite imagery is also used in seismology and oceanography in deducing changes to land formation, water depth and sea bed, by color caused by earthquakes, volcanoes, and tsunamis.

Because the total area of the land on Earth is so large and because resolution is relatively high, satellite databases are huge and image processing(creating useful images from the raw data) is time-consuming. Depending on the sensor used, weather conditions can affect image quality: for example, it is difficult to obtain images for areas of frequent cloud cover such as mountain-tops.

Key-words.. algorithm , remote sensing, supervised classification, unsupervised classification.

INTRODUCTION

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to in situ observation. In modern usage, the term generally refers to the use of aerial sensor technologies to detect (figure 1) and classify objects on Earth (both on the surface, and in the atmosphere and oceans) by means of propagated signals (e.g. electromagnetic radiation). It may be split into active remote sensing, when a signal is first emitted from aircraft or satellites) or passive (e.g. sunlight) when information is merely recorded. An overview about passive sensors detect natural radiation that is emitted or reflected by the object or surrounding areas. Reflected sunlight is the most common source of radiation measured by passive sensors. Examples of passive remote sensors include

film photography, infrared, charge-coupled devices, and radiometers. Active collection, on the other hand, emits energy in order to scan objects and areas whereupon a sensor then detects and measures the radiation that is reflected or backscattered from the target. RADAR and LiDAR are examples of active remote sensing where the time delay between emission and return is measured, establishing the location, speed and direction of an object.
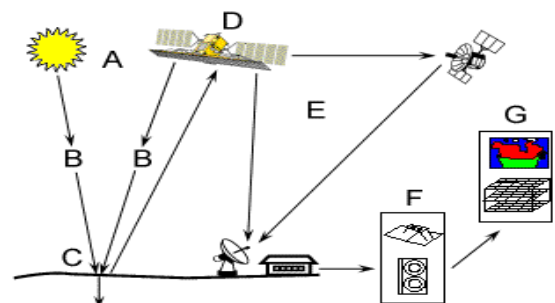

Figure 1. Principle of remote sensing

Energy Source or Illumination (A)
Radiation and the Atmosphere (B)
Interaction with the Target (C) Recording of
Energy by the Sensor (D)
Transmission, Reception, and Processing (E)
Interpretation and Analysis (F)
Application (G)

MATHERIALS AND METHODS

With ArcGIS program were made on the
classification of images Timisoara.
In the following we briefly describe the
Geographic Information System , the Timisoara
city and the types of image classification.
The Geographic Information System is a
collection of located, collected, stored and
managed geographic data with the use of the
computer, data which can be used to perform
various spatial analyses. The special GIS
operations over the spatial information make
from these instruments more than just efficacy
instruments for making maps, but especially,
irreplaceable instruments for analyzing the
information that refer to the terrestrial surfaces.
GIS maps must be made exploiting all
available resources based on rigorous analysis
of their content and the costs involved, seeking
assurance required with maximum efficiency.
The information obtained from remote sensing
is contained by the cosmic or aerial images,
which can be interpreted for many purposes.
Timișoara is the capital city of Timiș County,
in western Romania. One of the largest
Romanian cities, with a population of 319,279
inhabitants (the third most populous city in the
country, as of 2011), and considered the
informal capital city of the historical region
of Banat, Timișoara is the main social,
economic and cultural center in the western
part of Romania.
Timișoara lies at an altitude of 95 m on the
southeast edge of the Banat plain, part of
the Pannonian Plain. The rich black soil and
relatively low water table make this a fertile
agricultural region. Due to the hydrography
projects undertaken in the 18th century, the city
no longer lies on the Timiș River, but on
the Bega canal.
The climate which defines Timișoara city is
the temperate-oceanic climate (Köppen: Cfb)

and can be regarded as humid continental (Dfb)
when using an isotherm of 0 °C (32 °F). The
city characterizes the Southern-Eastern part of
The Pannonian Basin.
Image classification is grouping pixels that
make up the digital image in the form of
classes or land cover topics.
Image classification is grouping pixels that
make up the digital image in the form of
classes or land cover themes.
''In other words, spectral classification aims to
objectively mapping the areas of image
radiometric characteristics (reflectance and / or
remittance) similar.
Following the classification of image data
resulting thematic qualitative representing
specific categories based on spectral properties
and / or auxiliary data sources, as well as the
verification of land''(Popescu, et al.,2014).
Two common applications of remotely-sensed
images to rangeland management are the
creation of maps of land cover, vegetation type,
or other discrete classes by remote sensing
software such as:
1. In *unsupervised classification (figure2)*,
image processing software classifies an image
based on natural groupings of the spectral
properties of the pixels, without the user
specifying how to classify any portion of the
image. Conceptually, unsupervised
classification is similar to cluster analysis
where observations (in this case, pixels) are
assigned to the same class because they have
similar values. The user must specify basic
information such as which spectral bands to use
and how many categories to use in the
classification, or the software may generate any
number of classes based solely on natural
groupings.
Unsupervised classification yields an output
image in which a number of classes are
identified and each pixel is assigned to a class.
These classes may or may not correspond well
to land cover types of interest, and the user will
need to assign meaningful labels to each class.
Unsupervised classification often results in too
many land cover classes, particularly for
heterogeneous land cover types, and classes
often need to be combined to create a
meaningful map. In other cases, the
classification may result in a map that
combines multiple land cover classes of

interest, and the class must be split into multiple classes in the final map. Unsupervised classification is useful when there is no preexisting field data or detailed aerial photographs for the image area, and the user cannot accurately specify training areas of known cover type. Additionally, this method is often used as an initial step prior to supervised classification (called hybrid classification). Common clustering algorithms include K-means clustering, ISODATA clustering, and Narendra-Goldberg clustering.

1''.K-means algorithm requires the following actions: analyst determines the average number of clusters according to which automatically clusters are established central pixels, pixels surrounded by a multidimensional space that generates vectors expressing the average distances of each pixel in relation to center of a cluster. Actually reporting occurs each pixel to a class.

The result of K-means algorithm is an image different from the original, in which groups of pixels (clusters) are identified by means of conventional colors, making it possible to interpret them in accordance with reality for land''(Popescu, et al.,2014).

2.''Iterative Self Organizing Data Analysis algorithm requires the number of clusters can readjustment every iteration of algorithm. As in the previous case, the result of the algorithm is established through a Isodes new image the clusters are represented by conventional colors'' (Popescu, et al.,2014).
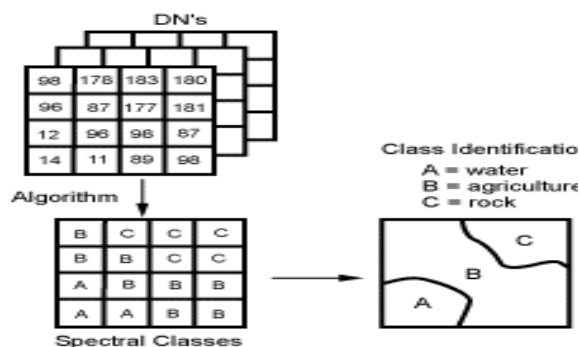
Figure 2. Unsupervised classification

In **supervised classification (*figure 3)***, the image processing software is guided by the user to specify the land cover classes of interest. The user defines "training sites" – areas in the map that are known to be representative of a particular land cover type –

for each land cover type of interest. The software determines the spectral signature of the pixels within each training area, and uses this information to define the mean and variance of the classes in relation to all of the input bands or layers. Each pixel in the image is then assigned, based on its spectral signature, to the class it most closely matches. It is important to choose training areas that cover the full range of variability within each land cover type to allow the software to accurately classify the rest of the image. Some of the more common classification algorithms used for supervised classification include the Minimum-Distance to the Mean Classifier, Parallelepiped Classifier, and Gaussian Maximum Likelihood Classifier.

1.''Minimum Distance to Means algorithm are based on the determination of the center of each group of pixels that represent the area of interest, then each pixel is reported by the vector distance from the area of interest and is assigned to the nearest class ''(Popescu, et al.,2014).

2.''Parallelepiped algorithm: a pixel is assigned a grouping if its spectral values fall between the minimum and maximum thresholds that are found in the training data for that group. The values of digital number of the pixel are automatically generated relative to a space around the groups of pixels area of interest, the system of two axes rectangular (rectangle) or three axes (parallelepiped)'' (Popescu, et al.,2014) .

3.''Gaussian Maximum Likelihood algorithm is based on the use of probability theory to compare the spectral values of each pixel in part to" mark" statistics in each area of interest. Basically probabilities are calculated conditional on belonging to a class or another'' (Popescu,et.al.,2014).

Supervised classification can be very effective and accurate in classifying satellite images and can be applied at the individual pixel level or to image objects (groups of adjacent, similar pixels). However, for the process to work effectively, the person processing the image needs to have a priori knowledge (field data, aerial photographs, or other knowledge) of where the classes of interest (e.g., land cover types) are located, or be able to identify them directly from the imagery. This method is often

used with unsupervised classification in a process called hybrid classification. Unsupervised classification can be used first to determine the spectral class composition of the image and to see how well the intended land cover classes can be defined from the image. After this initial step, supervised classification can be used to classify the image into the land cover types of interest.
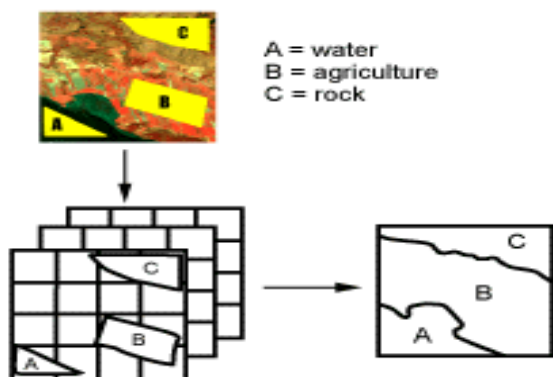

Figure 3. Supervised classification

RESULTS AND DICUSSIONS

In the following paragraphs are described two band combination of Landsat 5 and Landsat 8:
Landsat 5 Band Combination 742 (figure 4) - This band combination provides a "natural-like" rendition, while also penetrating atmospheric particles and smoke. Healthy vegetation will be a bright green and can saturate in seasons of heavy growth, grasslands will appear green, pink areas represent barren soil, oranges and browns represent sparsely vegetated areas. Dry vegetation will be orange and water will be blue. Sands, soils and minerals are highlighted in a multitude of colors. This band combination provides striking imagery for desert regions. It is useful for geological, agricultural and wetland studies. If there were any fires in this image they would appear red. This combination is used in the fire management applications for post-fire analysis of burned and non-burned forested areas. Urban areas appear in varying shades of magenta. Grasslands appear as light green. The light-green spots inside the city indicate grassy land cover - parks, cemeteries, golf courses. Olive-green to bright-green hues normally indicate forested areas with coniferous forest being darker green than deciduous.

Landsat 8 Band Combination 753 - This band combination also provides a "natural-like" rendition while also penetrating atmospheric particles, smoke and haze. Vegetation appears in shades of dark and light green during the growing season, urban features are white, gray, cyan or purple, sands, soils and minerals appear in a variety of colors. The almost complete absorption of Mid-IR bands in water, ice and snow provides well defined coast lines and highlighted sources of water within the image. Snow and ice appear as dark blue, water is black or dark blue. Hot surfaces such as forest fires and volcano calderas saturate the Mid-IR bands and appear in shades of red or yellow. One particular application for this combination is monitoring forest fires. During seasons of little vegetation growth the 7 4 2 combination should be substituted. Flooded areas should look very dark blue or black, compared with the 3 2 1 combination in which shallow flooded regions appear gray and are difficult to distinguish. This band combination also provides a "natural-like" rendition while also penetrating atmospheric particles, smoke and haze. Vegetation appears in shades of dark and light green during the growing season, urban features are white, gray, cyan or purple, sands, soils and minerals appear in a variety of colors. The almost complete absorption of Mid-IR bands in water, ice and snow provides well defined coast lines and highlighted sources of water within the image. Snow and ice appear as dark blue, water is black or dark blue. Hot surfaces such as forest fires and volcano calderas saturate the Mid-IR bands and appear in shades of red or yellow. One particular application for this combination is monitoring forest fires. During seasons of little vegetation growth the 7 4 2 combination should be substituted. Flooded areas should look very dark blue or black, compared with the 3 2 1 combination in which shallow flooded regions appear gray and are difficult to distinguish.
Below are presented two image classifications (Figures 5 and 6), which were processed from Landsat TM satellite image of 2013 covering Timisoara metropolitan area, processing performed using ArcGIS software v10.
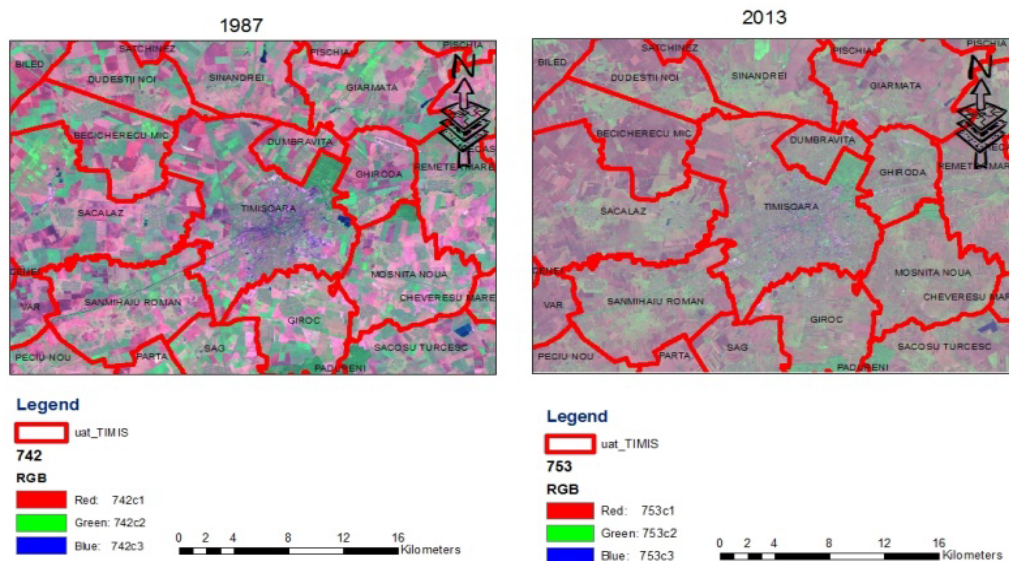The image from which we started this paper is presented below:

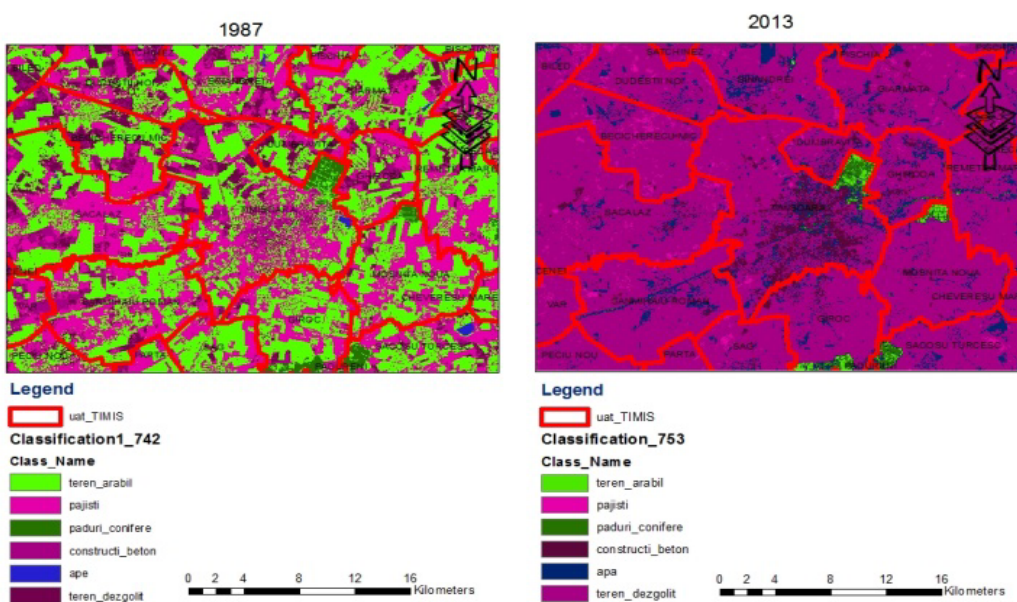Figure 4. Landsat 5 and Landsat 8 Band Combination (False Color)

Figure 5. Comparative evolution of the studied area based on supervised classification using six thematic classes
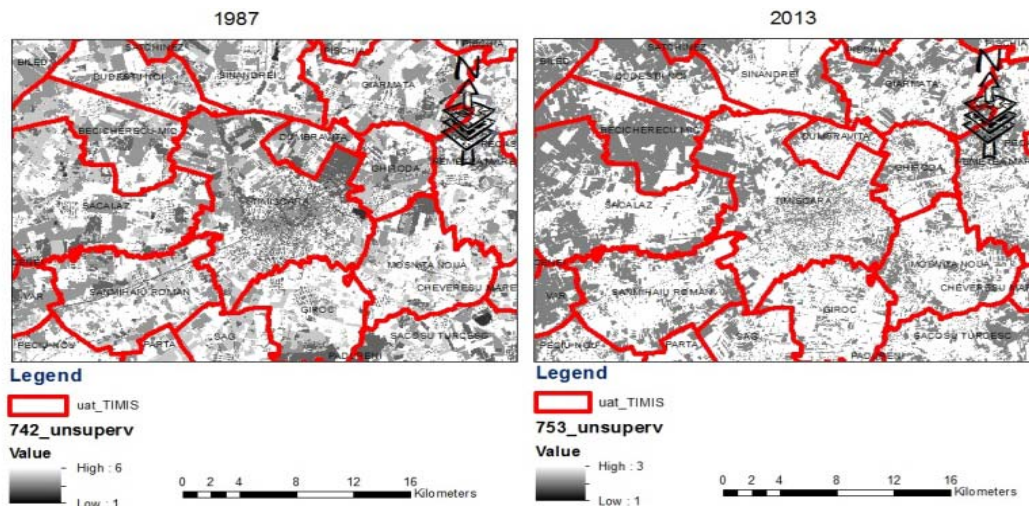
Figure 6. Comparative evolution of the studied area based on unsupervised classification using six thematic classes

CONCLUSIONS

In this paper are two sets of conclusions with advantages and disadvantages for each image classification as follows:

For unsupervised classifications the advantages are:

- Does not require knowledge of the analyzed region .
- Human errors are minimized .
- Pixels are spectrally separated from.
- The analyst has control over the number of classes, iterations, etc.
  And the disadvantages:
- Classes obtained not accurately reflect the categories of land.
- Limited control over the identity of classes.
- Spectral properties of classes may change over time.

For supervised classifications the advantages are:

- Control of class identity.
- Specific classes with specific identities.
- Classes obtained reflect the categories of land.
- Classification errors can be detected.

And the disadvantages:

- Analyst requires classification.
- The regions of interest are in the general information related to the pitch and spectral properties not .
- Inters regions may not be representative.
- Achieve ROI takes time.

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ADVANCE GIS ANALYSIS ON ZONAL URBAN PLAN PROJECT

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Abstract

According to Law 350/2001, the Zonal Urban Plan is the tool of urban planning area, of specific regulation, which coordinates the integrated urban development of local areas characterized by a high degree of complexity or a pronounced urban dynamics. The Zonal Urban Plan provides correlation of integrated urban development programs of the area with the General Urban Plan. The zonal urban plan is based on terrestrial measurements. The measurements were performed using total station and the GNSS technology. The plan was accomplised in ARCGIS software, which allowed obtaining quality cartographic elements and development of complex analysis. The studied territory is the Zizin area, situated in the East of Brașov City, which has an area of 298 hectares.

Key words: modern tools, zonal urban plan, urban planning ,surveying methods, interpolation.

INTRODUCTION

The Zonal Urban Plan for the Zizin area respects the regulations of the law 350/2001 and the Urbanism Certificate no. 879 from 22. 04. 2013. According to the Urbanism Certificate the land use in the Zizin area consists of subarea for constructions and communal facilities, subarea for cemeteries, subarea for green spaces, for public green spaces, mixed subarea, subarea for units of small and medium manufacturing and services, mixed subarea located outside the protected area, subarea of green spaces for recreation.

The zonal urban plan is based on the topographic plan, which is a graphical conventional representation, accurate, scale reduced, of a small area of land. (Nastase and Osaci-Costache, 2005)

MATERIALS AND METHODS

To accomplish the zonal urban plan, were used ,as methods of surveying, the traversing survey supported at the ends points and the vectoring of the areas that couldn't be surveyed due to the lack of visibility. The surveying equipment used consist in two GNSS equipment Leica GPS1200 (Figure 1) and a Total Station Leica TC405 (Figure 2).

Figure 1. GPS1200   Figure 2. TC405

The surveying points taken with the GNSS equipment used at increasing frequncy of geodetic network were post-processed with Leica Geo-Office software using ROMPOS corrections. The compensation of the traverse was made in Toposys software. With compensated coordinates and other data as orthophotos, cadastral plans and parcelling plans, followed achieving the database and the zonal urban plan in ArcGIS software. (Tereșneu and Tamaș, 2010).

RESULTS AND DISCUSSIONS

We can begin achieving the zonal urban plan once is approved the Opportunity Study by the

Local Board. The opportunity study and the zonal urban plan are made complying the Law 350/2001, Law 50/1991 and the Government Decision 525/1996.

In ArcGIS software you can't just lunch the application and start drawing like in the computer-aided design software, you need to follow some footsteps before.

The stages to achieve a cartographic element are:
- Creating a File Geodatabase in ArcCatalog;
- Creating a Feature Dataset in the geodatabase that holds the information about the coordinates systems;
- Creating in the feature dataset New Feature Classes for every type of feature that will exists in the future map: polylines, points, polygons, annotations etc.
- Import in ArcMap the created feature classes and the other data like ortophotos, cadastral plans and the parceling plans;
- Starting to unite the points and create symbols for every feature class according to the details from the terrain;
- Edit and display the labels and the annotation so as to be represented the hole toponymy of the site;
- Make the final configuration in the Layout view and prepare to print the map.

Following these steps you have a map that is ready to be used for the purpose which it was created for.

After it was created the database in ArcGIS, the achievement of the Z. U. P was only a matter of time. The data is structured on layers, making it easy to acces them (Figure 3).
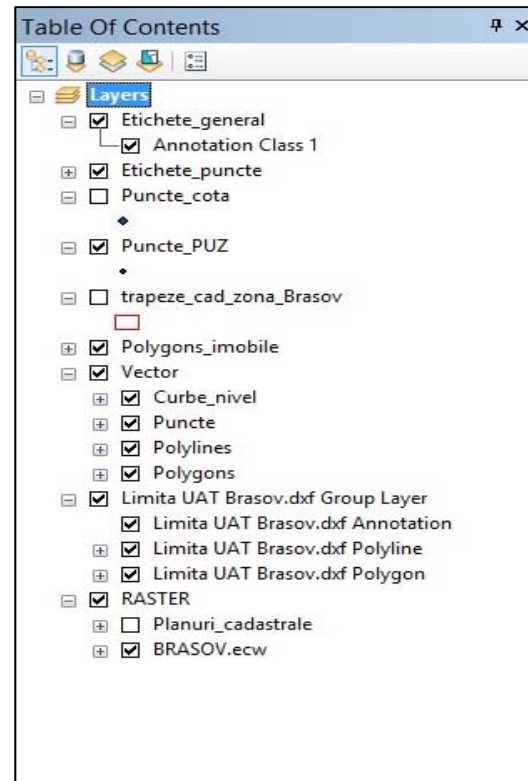
Figure 3. ArcGIS layers

The Symbology submenu (Figure 4) from the Layer properties help us to recreate with high fidelity the details that has been observed on the studied area. In this submenu, we can create unique symbols for points, polylines and polygons.
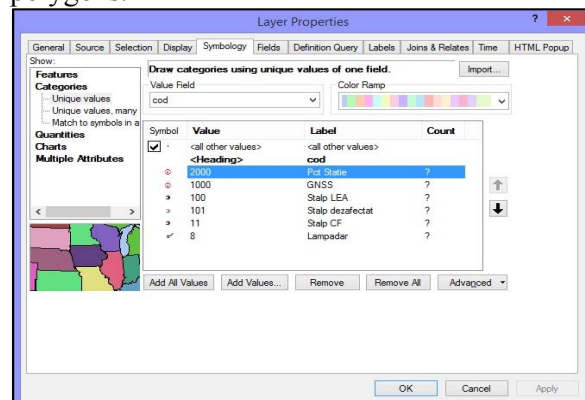
Figure 4. Layer properties page

The Labels submenu (Figure 5) from the Layer properties let us build special label using an expression to derive the label string from each feature. The expression need to be coded using the rules of the scripting language selected. The scripting languages that exists in the ArcGIS internal database are JScript and VBScript.

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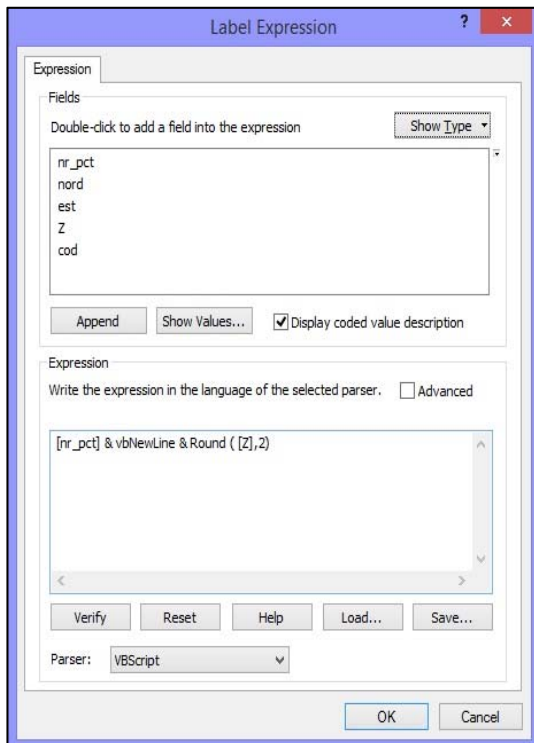
Figure 5. Label expression window

For exemple, the expression " [nr_pct] & vbNewLine & Round ([Z],2) " displays, in the VBScript language, a label which has the text structured on two lines and the second line text, the "Z" field, is rounded to two decimal places.

The accomplised topographic plan respects with fidelity the studied area and show all the technical and juridical elements that are present there (Figure 6).

Figure 6. Sector of the topographic plan overlapped above the orthophoto map

The contours presented in the topographic plan (Figure 7) were obtained using a function from ArcToolbox, the Contour function from Spatial Analyst submenu. This function creates a line feature class of contours (isolines) from a raster surface. (ArcGIS Help Window)

Initially I did contours with three types of equidistance: 0.5 m, 1 m, 1.5 m. After an analysis I consider that the most suitable are those with equidistance of 1 m.

Figure 7. Contours with 1 meter equidistance

The raster surface that the contours are based on, was generated using the elevation points measured on the field. To obtain the raster surface I used the Interpolation function from the same Spatial Analyst submenu. There are eight types of interpolation and I used three of them: IDW, Spline and Topo To Raster.

IDW interpolates a raster surface from points using an Inverse Distance Weighted technique. The output value for a cell is limited to the range of the values used to interpolate. This interpolation cannot create ridges or valleys if these extremes have not already been sampled. (Watson and Philip, 1986)
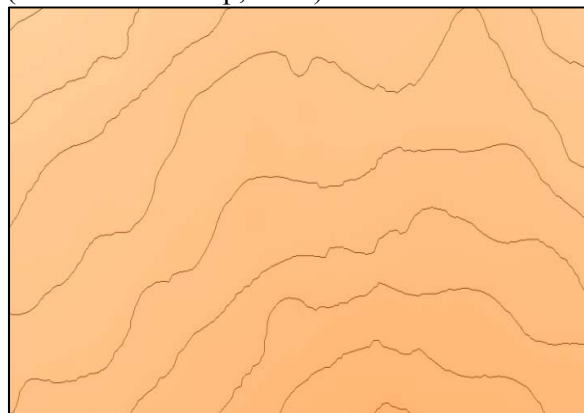
Figure 8. Contours based on IDW interpolation

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This contours were not used on the topographic plan because are too irregular (Figure 8).

Spline interpolates a raster surface from points using a two-dimensional minimum curvature spline tehnique. The resulting smooth surface passes exactly through the input points. The greater the value of elevation points, the smoother the surface of the output raster will be (ArcGIS 10 Help Window).
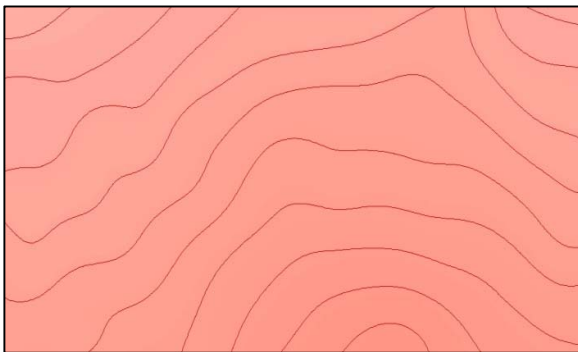
Figure 9. Contours based on SPLINE interpolation

The contours based on Spline interpolation fits perfectly over our needs and therefore I used it on the topographic plan (Figure 9).

Topo To Raster interpolates a hydrologically correct raster surface from point, line and polygon data. The best results will be obtained if all input data is stored in the same planar coordinate system and has the same ZUNITS. (ArcGIS 10 Help Window)

The input data in our case, is framed in the Stereographic 1970 Projection System and in the Normal Altitudes System Black Sea 1975.

Topo to Raster use only four input data points for the interpolation of each output cell. All additional points are ignored.
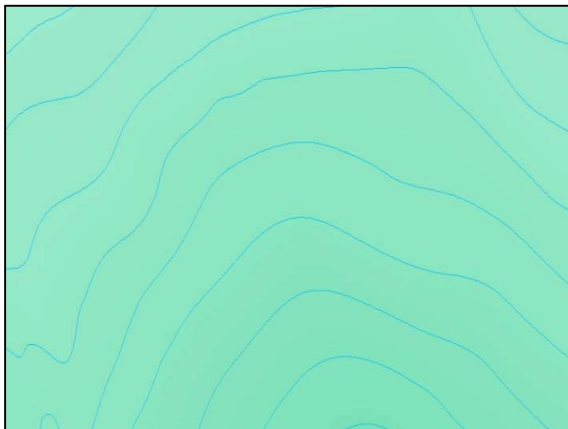
Figure 10. Contours based on Topo To Raster interpolation

The contours obtained with Topo To Raster interpolation are smooth but I don't used them on the plan because it's not using all the input data points and so it can lose a certain amount of output cell information (Figure 10).

After printing the topographic plan and filing the documentation, the file it's ready to be taken at O. C. P. I. for approval (Figure 11).

CONCLUSIONS

All the modern instruments and software allows us to gain high quality and accuracy in the achievement of the cartographic plans.

In the new softwares we can easy to experiment different methods of mapping and choose the best to get a finished product comply with regulations in force, but also the needs of beneficiaries.

ArcGIS is an attractive computer application, combining the visual and the numeric, the cartographic items are considered to be part art and part science. The database for each project can be updated continually and can offer information about all the elements that exists in the plan. Using the tools that exists in the software database allows us to analyze a variety of data. It has tools for 3D analyzes, geostatistics, spatial analyzes, spatial statistics and many others.

It will be a great improvment if A. N. C. P. I. will receive the entire GIS projects with all the information that are contained in them. They developed on a GIS platform eTerra Geoportal, but the information offered is poor and can be improved.

The GIS softwares may be the next stept in the evolution of the mapping.
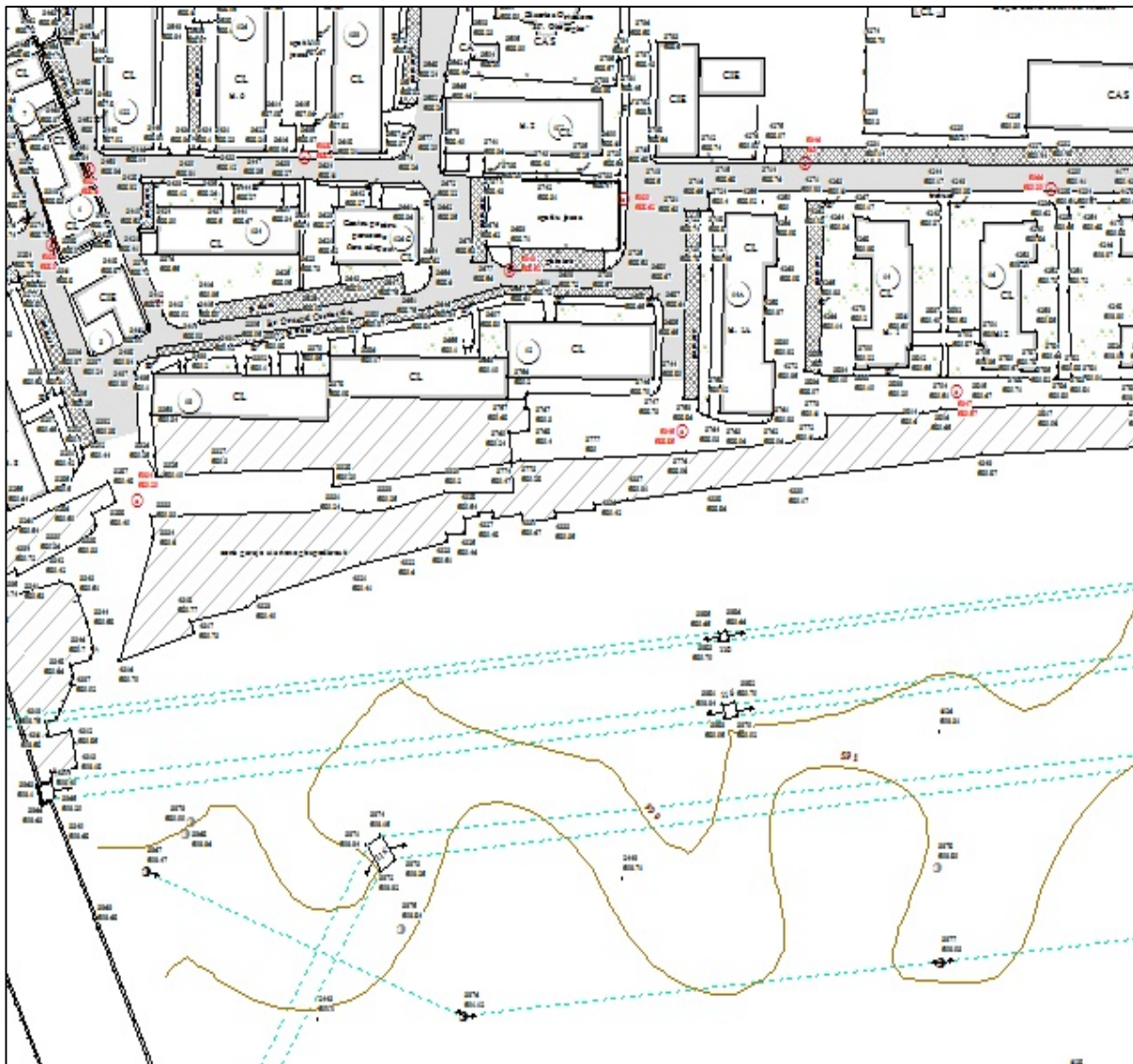
Figure 11. Sector of the topographic plan

ACKNOWLEDGEMENTS

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REPRESENTING CLIMATOLOGICAL DATA FOR ROMANIA USING ARCGIS ONLINE PLATFORM

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Abstract

In this paper I intend to represent the maximum and minimum air temperatures for every month on record in some areas of Romania. I chose to present this town on a map and for this I used StoryMap-ArcGIS online application because it's always easier to read a map. I inserted data, metadata and photos for every single location.

Key words: Geographic Informational systems, StoryMap ArcGIS Online, Earth Observation, Temperature, Clima.

INTRODUCTION

Story Maps, represents a web map format for a new type of users. This combines web maps with web applications and templates which offer information based on text, multimedia and different interactive functions in order to make maps for the purpose of education, inspiration.
The most used template is Storytelling Map Tour. This template combines a interactive map, a panel that shows pictures together with text and a scrolling section with miniature images.

MATERIALS AND METHODS

In order to make this project I used the ArcGIS Online platform for representing climatological data of Romania, such as: minimum and maximum air temperatures, unusualy high rainfall in each separate month. Climatological data was taken from the database of National Meteorological Administration interpreted and shown on GIS map.

RESULTS AND DISCUSSIONS

Before starting I created a GIS account on the following site: www.arcgis.com then I followed the instructions, completing the fields with necessary data (Figure 1).
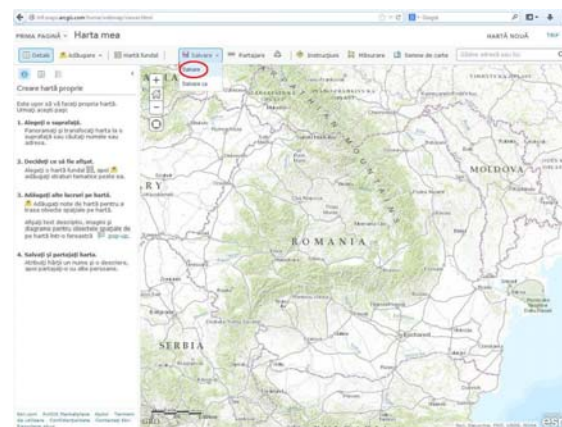

Figure 1

Figure 2

I clicked on Map option in order to make the web map, then I saved the project without adding any point on the map (Figure 2).

To continue I saved and completed all the fields concerning the future project such as: Title, Description, Key words, just like in Figure 3.
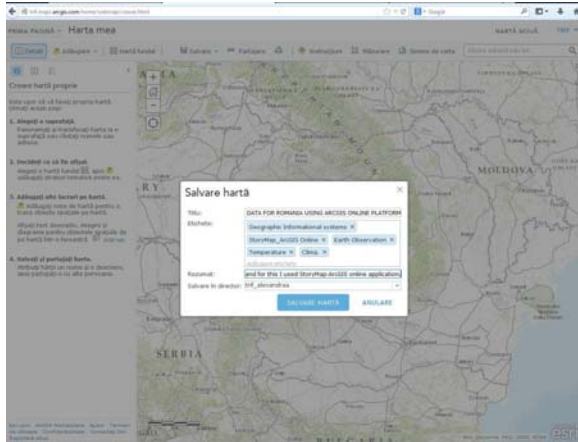

Figure 3

Next step is making the web application which is done following these steps:

First of all the map must be shared with all users. For this I have to click the "Share" button, tick the option that makes possible sharing with every user and choose the "Make a web application" option.

Then I move to the second application page and choose "Map Tour" then click on "Publish" (Figure 4).
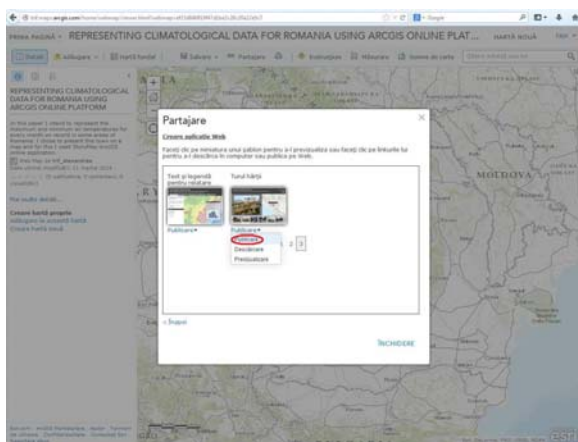
Figure 4

After this I choose "go to the item right now" (this option is inside the text "You can go to the item now to share and configure your application or click Close below to return to the map") (Figure 5).
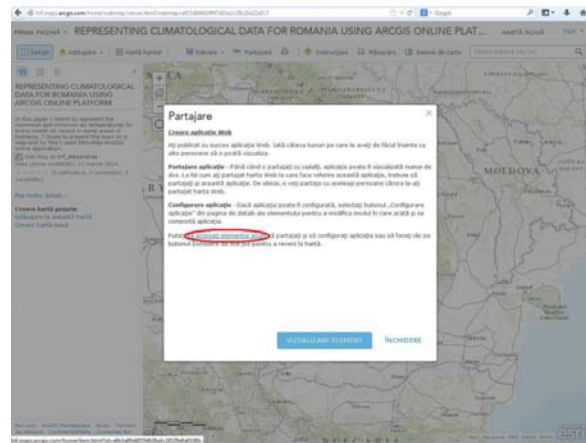
Figure 5

I then clicked on the thumbnail (or you can click on Open and select View application).

I selected the option "Start from scratch."

I choose "Add" for adding the first location on the map (Figure 5).

Then add the url location of the photos; This are the photos corresponding to the map locations which will be inserted. They must be uploaded on existing free internet sites using online accounts (Figure 6').

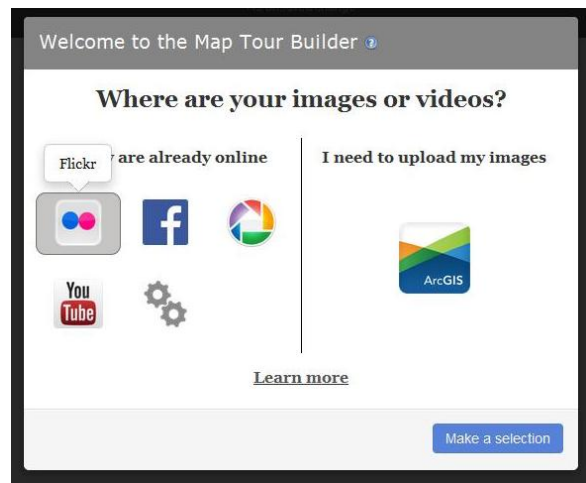In this way it's possible to use the same url address for Picture and Thumbnail.
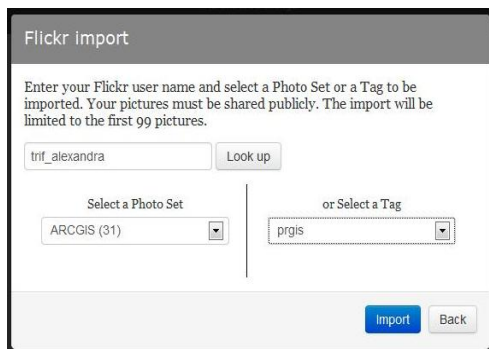

Figure 6

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Figure 6'

Completing the fields in Information section (name and description for the point added on map) Figure 7.
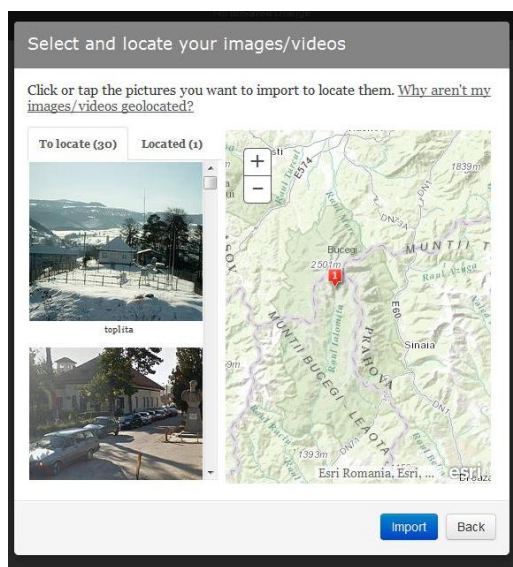

Figure 7

There are two ways for entering values in "Location" section. If geographical coordinates are known then latitude and longitude field will be filled, otherwise the icon will be moved and location point zoomed, in order to fix the point on a known location.

The topographic map used as background map for Tour Map application, gives the possibility to easily identify known locations.

Click on "Add tour point" after all tabs are completed.

Click on "Save" to save the application.

The same procedure is used for the rest of point to be added.

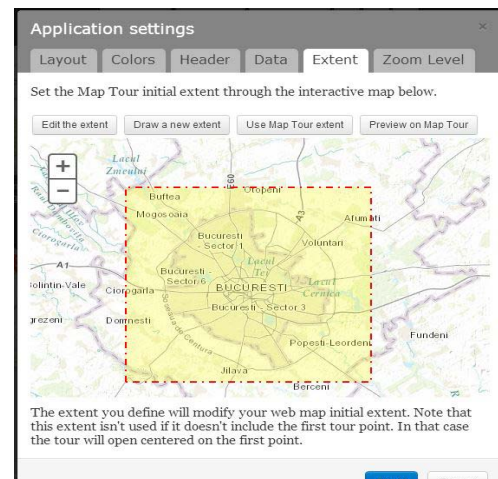Settings tab gives the possibility to customize the application (Figure 8).

Figure 8

Map Extent is another element which can be established depending on the area of cover/ interest.

Click on Extent tab and then on Draw new extent in order to establish the area of cover/ interest.

After establishing the extent, click on Apply and then click on Save.

Personalisation of application can be made after putting on the map all interest points based on new criteria, like for example: location order on the map, marker colour for field location points (Figure 9).
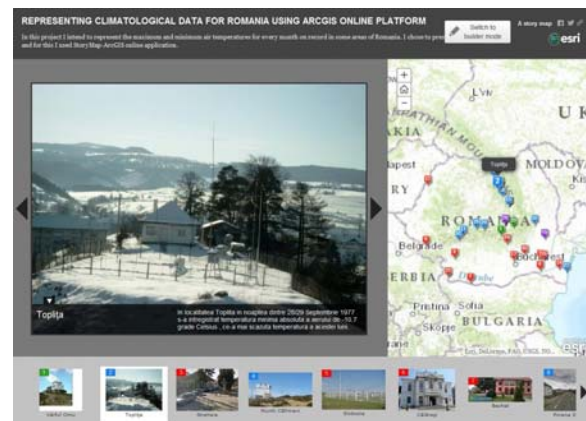

Figure 9

CONCLUSIONS

In conclusion making the GIS map was successful and I inserted all the possible values for Romania. The points are shown in the following figure (Figure 10).
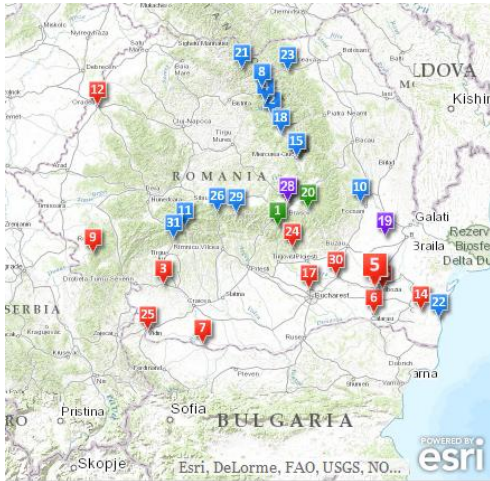

Figure 10

The red points on map show maximum values for air temperature, the blue points on map show the minimum values for air temperature, the green points show areas where at different dates were recorded minimum and maximum values for air temperature and the two indigo show the maximum air temperature ever recorded in Romania in the town of Ion Sion, Braila County, 44.5 degrees Celsius on 10 August 1951, respectively the minimum air temperature recorded in the town of Bod, Brasov county, -38.5 degrees Celsius the night of 24/25 January 1942. It's worth mentioning that the meteorological station in the town of Bod is no longer functional (Figure 12).

Figure 11

Figure 12

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